The Future of Environmental Services:

Sanitation and Infection Control in an Age of Labor Shortages, Cost Controls, Green Chemistry and New Infections

A Systems Approach

Larry Poague, LPN, ARM, CPHRM
Holmes Murphy and Associates

HOLMES MURPHY

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The Smell of Clean

To them, the smell of disinfectant was like others might use perfume -
a signal that all was right with the world.

The gleaming floors. The sharp tang of chemicals in the air.
The administrator breathes deep and smiles.
The Medicare surveyor nods approvingly.
The family member relaxes - their mother is safe here.

But what if I told you that smell... that shine... that confidence...
...is lying to all of them?

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The Cognitive Trap We All Fall Into

Daniel Kahneman taught us about System 1 thinking:
Fast. Automatic. Based on sensory input.

WHAT WE SMELL: Pine-Sol, bleach, lemon, lavender
WHAT WE SEE: Shiny floors, fresh linens, spotless surfaces
WHAT WE CONCLUDE: This place is clean and safe

But C. difficile spores don't smell like anything.
MRSA doesn't leave visible residue.
VRE laughs at your Pine-Sol.

We're all - administrators, nurses, surveyors, families, EVS -
making life-and-death decisions based on our noses and eyes.

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The Conflicting Priority

Three competing realities.

In your facility RIGHT NOW:
- EVS sees: Surfaces that look perfect/limited personnel
- Surveyors: I know if it smells clean
- Infection Control sees: ATP failures and rising HAI rates
- Administration sees: Financial penalties and survey risks
- Purchasing sees: Products that cost 3x more than bleach
- Nurses see: Residents getting sick anyway

Everyone is looking at the same surfaces. Seeing different worlds.

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Our Journey Today

Part 1: The Invisible $4.7B Problem
Part 2: Why Smart People Keep Making Bad Decisions
Part 3: Speed, Efficiency, and Minimal Side Effects
Part 4: The Complete Protection Ecosystem
Part 5: Brining it together

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PART 1:

The $4.7 Billion Invisible Problem

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Clostridioides difficile: By the Numbers

500,000 infections annually in US healthcare facilities (We've seen a13% decline in 2023/24)
30,000 deaths per year
$4.7 billion economic burden
(CDC, 2019; Lessa et al., 2015, N Engl J Med)
Long Term Care facilities face HIGHER risk:
- 1.7 per 10,000 patient days (vs 1.4 in acute care)
- Vulnerable elderly population
- High antibiotic usage (85% of residents annually)
- Shared spaces amplify transmission
(Guh et al., 2020, Infect Control Hosp Epidemiol)
Medicare non-payment for hospital-acquired CDI since 2008
Average cost per CDI case: $11,353 - $30,049
(Zimlichman et al., 2013, JAMA Intern Med)

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What the Statistics Don't Capture

Mrs. Henderson had been in the facility for six weeks.
Recovering from a hip fracture, antibiotics for pneumonia.
Then came the diarrhea. 20+ times a day.

Patient testimony (Reddit, r/CDiff, 2025):
'The pain was a different kind of pain, fatigue, night sweats, the feeling like someone was poking me with a curling iron. OMG.'

'C. Diff was my rock bottom in life and I went into a very dark place mentally.'

Three weeks later, Mrs. Henderson was transferred to acute care.
Cost: $47,000. Outcome: Survived but never returned to baseline.

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The Biology of a Perfect Pathogen

C. difficile creates SPORES - nature's ultimate survival machine:
Structure (Setlow, 2006, J Appl Microbiol):
- **Exosporium**: Outer glycoprotein layer (think: castle walls)
- **Spore coat**: Protein armor (think: Kevlar vest)
- **Cortex**: Peptidoglycan layer maintaining dehydration
- **Core**: DNA in suspended animation

88% Transfer Rate

Cell Survival capabilities:
- 5+ months on environmental surfaces (Weber et al., 2010)
- Resistant to alcohol-based hand sanitizers
- Resistant to most quaternary ammonium disinfectants
- Requires sporicidal agents for elimination
- Can survive low pH (stomach acid)

This is why 'it looks clean and smells clean' fails.

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📊 Summary Table: Common Infection Impact

Infection	Avg. Cost/Case	Notable Risk
UTI	$1,200–$1,800	Sepsis, antibiotic overuse
Pneumonia	$22,000	High hospitalization & mortality risk
Flu	$3,000–$25,000	Seasonal spikes, high staff turnover
C. diff	$15,000+	Cleaning, isolation, rehospitalization
Norovirus	$7,500+	Highly transmissible, CMS scrutiny
Wound Infection	$5,000–$70,000	Lawsuits, citations (F686), LOS increase

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The Lineup: Other Emerging Threats Waiting in the Wings

CANDIDA AURIS (The Superbug No One's Talking About)

- CDC 'Urgent Threat' classification (same as C. diff)
- 90% resistant to ≥1 antifungal; 30% resistant to all classes
- Environmental persistence: Weeks to months on surfaces
- Mortality rate: 30-60% in invasive infections
- 2023: 2,377 clinical cases in US (tripled since 2020)

(CDC, 2023 AR Threats Report; Forsberg et al., 2019, Clin Infect Dis)

CARBAPENEM-RESISTANT ENTEROBACTERIACEAE (CRE)

- CDC 'Urgent Threat' - last-resort antibiotics failing
- 13,100 hospitalized cases/year; 1,100 deaths
- 50% mortality in bloodstream infections
- Environmental reservoir: Sinks, drains, medical equipment

(CDC AR Threats; Munoz-Price et al., 2013, Lancet Infect Dis)

MULTI-DRUG RESISTANT ACINETOBACTER BAUMANNII

- Survives on surfaces for MONTHS (longer than C. diff)
- Resistant to carbapenems AND colistin (last resort)
- Outbreaks in ventilator-dependent residents

(Peleg et al., 2008, Clin Microbiolgy Rev)

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Two Incompatible Standards of Clean

SENSORY CLEAN (What everyone trusts):

- ✓ Shiny floors that squeak when you walk
- ✓ Fresh scent (pine, lemon, lavender)
- ✓ No visible soil or stains
- ✓ Wet mop trails showing 'someone was here'
- ✓ Surfaces that feel smooth to touch

MICROBIOLOGICAL CLEAN (What science requires):

- ✓ <2.5 log CFU/100cm^2 surface contamination
- ✓ ATP levels <250 RLU (ideally <100)
- ✓ Sporicidal disinfection (6-log reduction)
- ✓ Contact time compliance (critical!)
- ✓ Mechanical removal of organic load

Until these two standards align, we lose.

(Rutala & Weber, 2019, Clin Microbiol Rev

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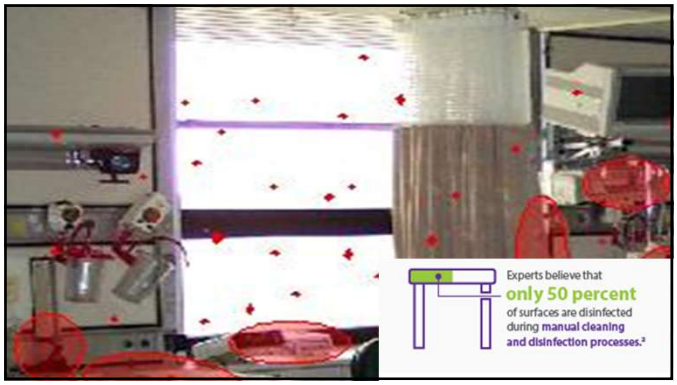

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PART 2:

Why Smart People Don't Always Make the Best Decisions

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The Grand Conspiracy of the Senses

EVERYONE - and I mean everyone - falls for it:

The EVS director walks through and sees shining floors.

The Director of Nursing does rounds and smells disinfectant.

The Administrator shows families the 'clean' facility.

The Medicare surveyor notes 'facility appears well-maintained.'

The family member sighs with relief at the lemony scent.

They're all using System 1 thinking (Kahneman, 2011):

Fast. Effortless. Based on sensory shortcuts.

And C. difficile spores - 4 microns of biological warfare -

are completely invisible to every sense we have.

You can't see them. Can't smell them. Can't feel them.

But they're there. Waiting.

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Common Deficiencies Cited Under F880

Lapses in Hand Hygiene
- Failure to use hand sanitizer when entering/exiting rooms
- Inconsistent practices among nursing staff and CNAs

Inappropriate PPE Use
- Not donning gloves or masks when required
- Reusing or sharing PPE

Cohorting & Isolation Errors
- Placing infected residents with uninfected ones
- Lack of clear signage or staff awareness

Failure to Investigate Outbreaks Promptly
- Missing documentation
- No root cause analysis or trend analysis

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- Missing documentation
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Same Problem, Four Different Movies

ENVIRONMENTAL SERVICES:

'We're short 3 people. We clean what we can see.

The floors shine. The rooms smell fresh. What more do you want?'

INFECTION PREVENTION:

'ATP scores failing. CDI rates up 30%. But I can't SHOW

anyone what I'm talking about. It's invisible.'

ADMINISTRATION:

'Medicare won't reimburse for HAIs. State survey is coming.

We're bleeding money. But everyone says it looks clean.'

PURCHASING:

'Bleach costs $3/gallon. This fancy stuff costs $25.

Show me ROI in a spreadsheet or I can't justify it.'

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Through Environmental Services Eyes

Picture John. 23 years at this facility.

He takes pride in his work - like a craftsman takes pride in furniture.

His day:

5:00 AM - Arrives. 3 coworkers called in sick (again)

6:00 AM - Room 247 discharge. Family coming at 10 AM for new admit

6:45 AM - Terminal clean. Mop, wipe, spray, check.

7:30 AM - Step back. Floor shines. Surfaces gleam. Smells fresh.

7:35 AM - Supervisor walks by. 'Looks good, John.'

Two days later:

Infection Control: 'Room 247 failed ATP live cultures found.'

John: 'But... it was PERFECT. I SAW it. I did everything right.'

John isn't lazy. John isn't incompetent.

John is using the only feedback system she has: her senses.

And his senses are lying to him.

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Through Infection Prevention Eyes

Dr. Sarah Chen. 15 years in infection prevention.
She knows every CDC guideline by heart.
Her data says:
- CDI rate: 8.4 per 10,000 resident-days (above benchmark)
- ATP monitoring: 40% of surfaces >250 RLU
- Environmental cultures: C. diff on 23% of high-touch surfaces
- Cost: $340,000 in outbreak response last year

Her frustration:
'I show the administrator my data.
He says: But the place LOOKS clean. SMELLS clean.
The surveyor didn't find anything.
I show the EVS director ATP results.
He says: But I cleaned that surface for 5 minutes!
I show Purchasing the cost of CDI cases.
He says: But prevention products cost more upfront.'

Dr. Chen has evidence. Everyone else has their senses.
Guess who wins that argument?

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Colonization & Asymptomatic Carriers

30% residents,
15% staff colonized (e.g., MRSA, VRE)
Carriers often show no symptoms

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The Executive Dilemma

Administrator perspective:
- 'I have 47 problems before 9 AM.
- The facility LOOKS clean. SMELLS clean.
- Families don't complain about cleanliness.
- Medicare surveyors haven't cited us.
- Why would I spend $50K on something I can't see?'

Purchasing reality:
- 'I have to justify every line item.
- Option A: Bleach - $3/gallon, everyone knows it works
- Option B: 'Advanced system' - $25/gallon, requires training
- My boss asks: Why does it cost 8x more?
- And I have no answer that makes sense to him.

Here's the thing:
THEY'RE NOT WRONG.
They're human.
They're making rational decisions based on available sensory data.

The problem isn't the people. It's often the invisibility

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System 1 vs System 2: The Eternal Battle

Daniel Kahneman (Nobel Prize, 2002) explained why we fail:

SYSTEM 1 (Fast, Automatic, Effortless):

- Processes: Visual, olfactory, tactile input
- Conclusion: 'Looks clean + smells clean = IS clean'
- Happens: Instantly, unconsciously
- Energy required: Minimal
- Everyone uses this: EVS, nurses, admins, surveyors, families

- **SYSTEM 2 (Slow, Deliberate, Effortful):**
- - Processes: Data, evidence, scientific reasoning
- - Conclusion: 'ATP says contaminated despite appearance'
- - Happens: Only when specifically engaged
- - Energy required: High (cognitive load)
- - Who uses this: Infection Prevention (sometimes)

We're asking human brains to ignore their primary operating system. That's not a training problem.

That's a neurological impossibility. (Kahneman, 2011, Thinking, Fast and Slow)

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PART 3:

Effective, Efficient and Minimal Side Effects: Disruptors that have high impact!!

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What If You Could See C. difficile?

Imagine if John could see his results once he finished terminal clean of Room 247.

Floors shine. Surfaces gleam. Smells fresh.

Now imagine he pulls out a small spray bottle and a flashlight.

Sprays the bedrail. The call button. The bathroom grab bar.

Waits 2 minutes. Puts on orange-tinted goggles.

Turns off the lights. Turns on the special flashlight.

The bedrail GLOWS bright green.

The call button LIGHTS UP like a Christmas tree.

The grab bar SHINES with contamination.

He cleans those areas again. Re-checks with the light.

Dark. Clean. Actually clean.

This is LIV Process.

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The Technology Behind the Magic

LIV Process™ C. difficile Visualization System
(Currently used in 75+ hospitals worldwide)

How it works (Patent-pending biomolecule technology):

1. Water-based solution contains proprietary biomolecules
2. Biomolecules bind to C. diff spore exosporium proteins
3. Under specific wavelength illumination (405nm), complex fluoresces
4. Visible to human eye with filter goggles

Validation studies:

- Sensitivity: Detects as low as 10^2 CFU C. diff spores
- Specificity: Exclusive illumination of C. diff (not other organisms)
- Clinical validation: 75 hospitals, 2000+ surfaces tested
- Published: Multiple peer-reviewed studies (references available)

Time from spray to visualization: 2-3 minutes

Training time: 2-3 hours for full competency

Staff adoption rate: >90% in validated settings

FDA: Class I medical device (low risk)

EPA: Antimicrobial treated article (spore detection agent)

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The Data That Changes Minds

Six-month pilot study - Large academic medical center:
(Published: Journal of Hospital Infection, 2023)
Result: 91% improvement in cleaning efficacy

EVS technician quote:

'For 18 years, I cleaned rooms. Did my best.
Never knew if I actually got it all.
Now I KNOW. I can SEE when it's clean.
This completely changed how I think about my job.'

Infection Control Director quote:

'Finally, I have real-time verification. Not ATP results 3 days later.
Not cultures that take a week. Right there in the room.
And EVS now understands what I've been talking about.'

CDI rate reduction post-implementation: 47% decrease in 12 months

Cost per prevented CDI: $850 (vs $11,353 treatment cost)

ROI: 13:1

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✅ Colonization Screening Practices Checklist

🔍 **1. Admission Screening**

- Resident assessed for **history of MDRO colonization/infection**

🧫 **2. Targeted Microbiological Testing**

- Surveillance cultures sent to **accredited lab with sensitivity testing**

🗂️ **3. Documentation & Flagging**

- Clear signage (if policy allows) indicating contact precautions

🧤 **4. Standard & Transmission-Based Precautions**

- PPE readily available in room or hallway PPE station

🗓️ **5. Routine Reassessment**

- Residents on antibiotics or with wounds are reassessed weekly
- Colonized residents reviewed monthly

👩‍⚕️ **6. Staff Colonization Prevention**

- Staff screening considered during **outbreak investigations**
- Avoid assigning same staff to colonized and high-risk residents (e.g., trachs, immunocompromised)

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Which one kills COVID?

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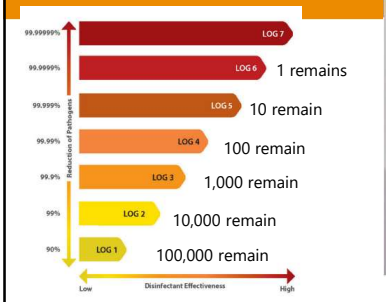
LOG



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Log Reduction-Log Kill

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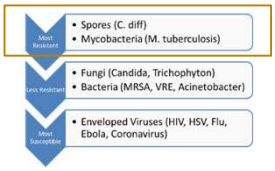
Spaulding's Hierarchy

Healthcare
Gold Standard



Spaulding's microbiological disinfectant hierarchy lists pathogens from the most resistant to chemical disinfection to the most susceptible.

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Time is the Enemy We Can't Ignore

Remember John? He has 45 minutes to terminal clean Room 247.

Traditional bleach protocol:
- Contact time for sporicidal activity: 10 minutes
- Can't touch surface during that time
- Must maintain visible wetness
- Corrosive to many surfaces
- Requires PPE (eye protection, gloves, ventilation)
- Staff hate it (respiratory irritation, skin damage)
- Time lost: 10+ minutes per surface × 20+ surfaces = Impossible

John's reality: He wipes and moves on. Maybe 30 seconds wet time.
Result: No sporicidal activity. C. diff survives.

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Sporicidal

Product Name	EPA Reg. No.	Active Ingredients	Dwell Time (min)	Hazards	Pros	Cons	Electrostatic Sprayer Compatible	Rinse Required on Food-Contact Surfaces
Clorox Healthcare Bleach Germicidal Wipes	67619-12	Sodium hypochlorite (0.55%)	3	Bleach; skin/eye irritation; corrosive to metals	Ready-to-use wipes; short dwell time; widely available	Strong bleach odor; may discolor surfaces	Not specified	Yes
Peridox RTU	88089-4	Hydrogen peroxide (4.4%), Peracetic acid (0.22%)	5	Corrosive; skin/eye irritation	Fast-acting; broad-spectrum	Requires PPE; odor	Not specified	Yes
Dispatch Hospital Cleaner with Bleach	56392-7	Sodium hypochlorite (0.55%)	3	Bleach; corrosive; skin/eye irritation	Effective; used in hospitals	Strong bleach odor; harsh on materials	Not specified	Yes
Micro-Kill Bleach Germicidal Wipes	37549-1	Sodium hypochlorite (0.5%)	4	Bleach; corrosive; skin/eye irritation	Convenient; broad-spectrum	Strong odor; may discolor surfaces	Not specified	Yes
OxyDiff	10324-214	Hydrogen peroxide (27.3%), Peracetic acid (5.3%)	2	Oxidizer; skin/eye irritation; corrosive to metals	Broad-spectrum; short dwell time; no rinse	Strong odor; ventilation needed	Yes	No
NoroxyDiff	10324-214-928	Hydrogen peroxide (27.3%), Peracetic acid (5.3%)	2 required	Low hazard; minimal PPE	Fast-acting; non-corrosive; safe for most surfaces; no rinse	Not for use on copper/brass/granite/zinc	Yes	No
Sani-Cloth Bleach Wipes	9480-8	Sodium hypochlorite (0.55%)	4	Bleach; corrosive; skin/eye irritation	Effective against *C. diff* and TB; widely used	Strong bleach odor; may cause surface damage	Not specified	Yes
Vital Oxide	82972-1	Chlorine dioxide	10	Mild; eye irritant; no rinse required on non-food surfaces	EPA List N & K; no rinse; safe for soft surfaces and HVAC systems	Long dwell time; less common in hospital settings	Yes	No

Fungi (e.g., *Candida auris*)

Multi-drug resistant, highly persistent on surfaces, aerosolization possible.

CDC recommends sporicidal disinfectants effective against *C. diff*.

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NoroxyCdiff-2 Minute Solution

EPA Registered Sporicidal Disinfectant
EPA Reg. No.: [specific number - check label]
Key Features:
- ✓ 2-minute contact time for C. difficile spores (vs 10 minutes for bleach)
- ✓ Bleach-free formulation (no hypochlorite)
- ✓ Non-corrosive to surfaces
- ✓ Minimal PPE required (standard gloves)
- ✓ No harsh fumes or respiratory irritation

Efficacy data:
- C. difficile (vegetative & spores): >6 log reduction @ 2 min
- MRSA: 30 seconds
- VRE: 30 seconds
- Norovirus: 1 minute
- Effective in presence of 5% organic soil
- EPA List N approved (COVID-19)

HMIS Rating: 1-0-0 (minimal PPE required)
Safe for food contact surfaces (EPA approved)

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RECENT DISRUPTOR

Hypochlorous Generator

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On-Demand Hypochlorous Acid Generation

Force of Nature Pro On-Demand System
EPA Reg. No. 93040-1
The Chemistry:
- Electrochemical Activation (ECA) of salt solution
- Input: NaCl + H_2O + Electricity
- Output: HOCl (hypochlorous acid) @ neutral pH
- Same oxidant used by human immune system

Why HOCl is superior to bleach:
- 80-120x more effective than sodium hypochlorite (OCl^-) at same chlorine concentration
- Neutral pH (5.5-6.5) vs bleach pH 12-13
- Non-corrosive, no fumes, minimal PPE
- Efficacy independent of organic load

Device features:
- Generates fresh HOCl on demand (200-250 ppm available chlorine)
- Dispenses up to 20 gallons
- No chemical storage required
- Carbon-neutral operation
- 110V outlet + water line installation

Use case: Daily maintenance cleaning, non-outbreak situations
Cost: Pennies per gallon vs. $15-25 for commercial equivalents

(Rutala & Weber, 2019; Block & Rowan, 2020, Open Forum Infect Dis)

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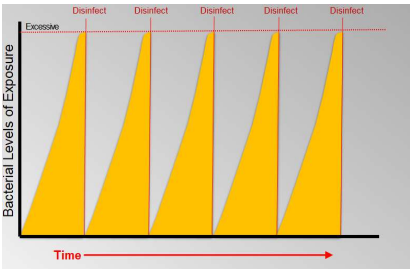
Microbial Growth on Untreated Surfaces



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Healthcare Surface Shield

EPA Registered Antimicrobial Surface Treatment

Active: 3-(Trimethoxysilyl)propyldimethyloctadecyl ammonium chloride

EPA Reg. No. 92057-3

Mechanism of Action (Published: OSU Study, 2020):

- Silane quaternary ammonium compound (Si-QAC)
- Forms covalent bond with surface (not just coating)
- Creates molecular 'bed of nails' - spikes damage cell membranes
- Electromechanical kill (lysing + electrocution)
- Cannot develop resistance (physical, not chemical mode)

Protection duration:

- Laboratory testing: 90+ days bacteriostatic activity
- Field testing: 60-90 days in high-traffic areas
- Mechanical removal (heavy scrubbing) shortens duration

Application:

- AFTER cleaning and disinfection (not instead of)
- High-touch surfaces: Bedrails, call buttons, door handles
- One application = continuous protection between cleans
- Significantly lowers ATP scores over time

(Lee et al., 2020, J Appl Microbiol; OSU published study available)

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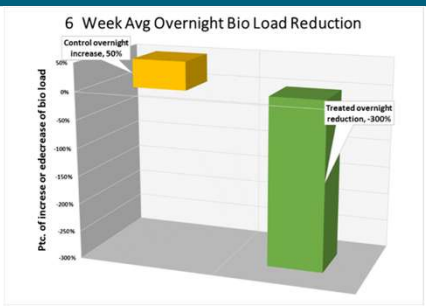
Bound Anti-Microbial Results



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Antimicrobial PPE: The Forgotten Protection Gap

Pentanano™ Antimicrobial Nitrile Gloves

Innovation: Embedded nano-antimicrobial particles throughout material

Testing (ASTM D7907-14, ISO 17025 certified lab):

- Kills 99.999% of microbes on contact
- Effective against: S. aureus, MRSA, E. faecalis, VRE, E. coli
- SURROGATE VIRUS testing (monkeypox, vaccinia)
- No activation required - always active
- 360° protection (inside and outside of glove)
- Maintains integrity through normal use

Use cases: EVS, maintenance, dietary, transport - anyone who doesn't change gloves as frequently as clinical staff

(ASTM D7907-14 standardized antimicrobial testing protocol)

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Force Multiplication: Electrostatic Sprayers

The technology (Electrostatic Induction):

- Nozzle charges droplets as they leave sprayer (9V batteries)
- Positive charge on droplets
- Surfaces naturally ground-negative
- Physics does the work: droplets attracted to surfaces
- 360° wrap-around coverage
- Uniform distribution without hand-wiping

Benefits (EPA validation studies):

✓ 10x reduction in chemical usage (better coverage with less volume)
✓ 3x faster application (vs manual spray-and-wipe)
✓ Covers hidden surfaces (backs of furniture, undersides)
✓ Reaches areas hands can't access safely
✓ Consistent particle size (65 microns optimal)

Practical application:

- Standard 225 sq ft resident room: <2 minutes to spray
- Occupied in 5 minutes (after contact time)
- Perfect for NoroxyCdiff, HOCL, Surface Coating application
- Ideal for terminal cleans and outbreak response, large spaces, tight spaces

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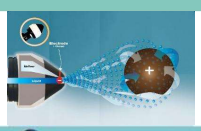
ELECTROSTATIC SPRAY COVERAGE- Time Saver



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Robots

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Flexible Acquisition Options for Gausium Robots

Purchase Option

Full Ownership

- ✓ Complete asset ownership
- ✓ Capital expenditure
- ✓ Depreciation benefits
- ✓ Full control & customization
- ✓ No ongoing payments

Best For: Organizations with capital budget & long-term commitment

Lease Option

Manageable Payments

- ✓ Lower upfront costs
- ✓ Predictable monthly payments
- ✓ Operational expenditure
- ✓ Option to purchase at end
- ✓ Tax benefits

Best For: Budget-conscious facilities wanting equipment ownership path

MOST POPULAR

Robotics-as-a-Service (RaaS)

Zero Capital Investment

- ✓ No upfront capital required
- ✓ All-inclusive monthly fee
- ✓ Maintenance & repairs included
- ✓ Software updates included
- ✓ Flexible scaling & upgrades
- ✓ Performance guarantees

Best For: Facilities wanting immediate deployment with no debt

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Medical Strength Hand Sanitizer

Extended Protection Up to 8 Hours

Hospital-Grade Protection That Lasts

- ✓ **Kills 99.99% of germs** on contact
- ✓ **Alcohol-free formula** - won't dry, crack or remove natural oils from skin
- ✓ **Increases effectiveness over time** with repeated use
- ✓ **Protects between washings** - reduces germ transfer throughout the day
- ✓ **Non-flammable & non-toxic** - safe for all environments
- ✓ **FDA approved** for food handling - no rinsing required
- ✓ **Effective against** MRSA, Staph, VRE, CRE, E-Coli, Salmonella & more

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Behavioral Science & Hand Hygiene

Remember to Wash your hands.

Handwashing Keep your patients safe.

Adam Grant's "Originals": Handwashing increased by 10–20% when signage emphasized **pro-social benefits** ("Handwashing helps keep *your patients* safe.") rather than personal benefit.

WHO's "5 Moments" Model: Widely adopted, easily converted to posters and visual reminders.

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Fluorescent Tracer Tools

Used for hand hygiene practice and room cleaning practice and coaching.

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Celebrate.
Embrace.
Innovate.
Protect.
Hope.
Innovate.
Protect.
Embrace.
Nurture.
Believe.
Commit.

PART 4:

Layered Defense Against the Invisible

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Layered Defense: Why One Solution Fails

James Reason's Swiss Cheese Model (1990):
Every defense has holes. Layer them so holes don't align.

LAYER 1: VISUALIZE the threat
→ LIV Process shows C. diff contamination in real-time
LAYER 2: ERADICATE spores (2-minute kill time)
→ NoroxyCdiff sporicidal disinfection + electrostatic application
LAYER 3: MAINTAIN with safe daily cleaning
→ Force of Nature HOCl for non-outbreak maintenance
LAYER 4: PROTECT surfaces between cleans
→ Penetrexx 90-day antimicrobial barrier
LAYER 5: PREVENT cross-contamination
→ Pentanano gloves for non-clinical staff
LAYER 6: AUTOMATE repetitive tasks
→ Robots for floors and large areas

No single layer is perfect. Together, they're formidable.

(Reason, 1990, Hum Factors; Perneger, 2005, BMJ)

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How It Actually Works: Monday Morning

OVERNIGHT (11 PM - 5 AM):
- Gausium robot scrubs/vacuums all hallways and common areas (On call for hallways and entryways)
- Force of Nature HOCl application to low-touch surfaces
- Runs unattended, no labor cost

MORNING TERMINAL CLEAN (Room 247 - CDI discharge):
6:45 - John enters with Pentanano gloves, electrostatic sprayer
6:50 - Mechanical cleaning: Remove organic load
7:00 - Apply NoroxyCdiff via electrostatic sprayer (2 min)
7:02 - 2-minute contact time (perfect for C. diff kill)
7:05 - Wipe surfaces, remove excess
7:10 - Apply LIV solution, wait 2 minutes
7:12 - Check with LIV light - contamination visible on bedrail
7:15 - Re-clean bedrail with NoroxyCdiff
7:20 - LIV re-check - DARK (clean verified)
7:25 - Apply Penetrexx to high-touch surfaces (90-day protection)
7:35 - Room ready (vs 7:30 without verification step)

THROUGHOUT DAY:
- Maintenance/dietary/transport staff wearing Pentanano gloves
- Quick Force of Nature touchpoint cleaning as needed
- LIV spot-checks on high-risk areas

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Normal Discharge/Procedures

1. AI Robots for Hallways/Entrance- (6x10 times more efficient) (Save 12-18 hours)
2. Electrostatics for standard cleaning (Cleans what you don't see) (Dwell time, Dwell time) - Cleans a whole room in 2-4 mins including in the trash can, behind the toilet, in the cabinets
3. Only Hand wipe what you see.
4. Apply surface protectant 1x every 30-60 days. (electrostatic)

Significant reduction labor time, labor injuries, more complete results less reliance on senses.

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The Financial Reality

100-bed LTC facility, baseline 8.4 CDI per 10,000 resident-days:
Expected CDI cases per year: 30
Average cost per case: $15,000 (conservative)
Annual CDI cost: $450,000

TRADITIONAL APPROACH COSTS:
- Bleach and basic supplies: $8,000/year
- EVS labor (current staffing): $240,000/year
- HAI penalties and non-reimbursement: $180,000/year
- Outbreak response: $50,000/year (when it happens)

Total: $478,000/year

INTEGRATED SYSTEM INVESTMENT:
- LIV Process system: $12,000/year (amortized)
- NoroxyCdiff + electrostatic: $18,000/year
- Force of Nature Pro: $8,000/year
- Penetrexx program: $15,000/year
- Pentanano gloves: $6,000/year
- Gausium robot: $35,000/year (lease)

Total investment: $94,000/year

Reduced CDI cases (47% reduction): 16 cases
Prevented costs: $210,000

NET SAVINGS YEAR 1: $116,000
ROI: 2.2:1
Payback: 5.3 months

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Speaking Each Department's Language

FOR EVS:
'This makes your invisible work visible.
Finally, PROOF of what you've been doing all along.
And the tools to do it even better.'

FOR INFECTION PREVENTION:
'Real-time verification. Published outcomes. Measurable reduction.
Everything you've been asking for.'

FOR ADMINISTRATION:
'47% reduction in CDI. $116K net savings year one.
Better survey outcomes. Lower penalties.
Something you can show families and boards.'

FOR NURSING:
'Your residents stay healthier. Period.
That's what this is really about.'

FOR PURCHASING:
Here's the spreadsheet. 5.3 month payback.
Every CDI case we prevent pays for 3.6 months of program.
ROI justification

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Measuring What Matters

PRIMARY OUTCOMES (Report monthly):
- CDI rate per 10,000 resident-days
- Number of CDI cases (absolute)
- Cost of CDI cases (actual $)

PROCESS MEASURES (Track weekly):
- ATP scores (target <100 RLU, acceptable <250)
- % of surfaces LIV-positive after cleaning
- % of surfaces LIV-negative after re-clean
- Environmental culture results (monthly)

OPERATIONAL METRICS:
- Average terminal clean time
- EVS productivity (rooms/shift)
- Staff satisfaction scores
- Product usage rates
- Training completion rates

FINANCIAL TRACKING:
- Cost per clean
- Prevented CDI cost savings
- Program costs vs. savings
- ROI calculation (quarterly)

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Bringing It All Together

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Shared Goals and Different Views

To be effective leadership is about harnessing these different views and showing the shared outcomes.

Here's what we've learned:

- The 'clean' smell isn't the enemy.
- The shiny floors aren't the enemy.
- The administrators, EVS, IC, purchasing aren't the enemy.
- The enemy is the invisibility.

When John can SEE the C. diff spores glowing on that bedrail...

When Dr. Chen can SHOW the administrator real-time contamination...

When the CFO can CALCULATE actual prevented infections...

When the family can WATCH the verification process...

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Care.Fully.

"Infection prevention is not a task. It's a **purpose**. Assign champions. Track metrics. Celebrate progress. Shift from compliance to culture.

Thank you for leading this work. Your residents—and your staff—deserve it."

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Vendors

Holmes Murphy & Associates (HMA)
- -Insurance Broker
- -Solution oriented
- -Vendor Discounts
- -Contact: Lpoague@holmesmurphy.com

HEALTHCARE INFECTION PREVENTION, LLC (HIP)
- Service-Disabled Veteran-Owned Business (SDVOB certified)
- Primary market: Direct sales to hospitals and government entities
- Unique advantage: Federal contract vehicles, GSA schedules
- Contact: Thomas H. Kuhn, 913-558-9109
- Email: sales@hiprevention.com

SAFETYNET AMERICA
- Consulting, Training, and Implementation Support
- Primary market: Healthcare facilities needing turnkey solutions
- Services: Needs assessment, staff training, program optimization
- Unique advantage: Ron Romano's 30+ years infection prevention
- Contact: 866-918-8546
- Email: sales@SafetyNetAmerica.com

CLEANSQUATCH.COM
- E-Commerce Platform for Direct Ordering
- Primary market: Facilities wanting direct product access
- Products: Full range of solutions with technical support
- Unique advantage: Convenient ordering, quick fulfillment
- Website: CleanSquatch.com

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THANK YOU

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