

CleanWhite® Surface Disinfection

## Use Case: Athletic Facilities, Fitness, and Academic Sports

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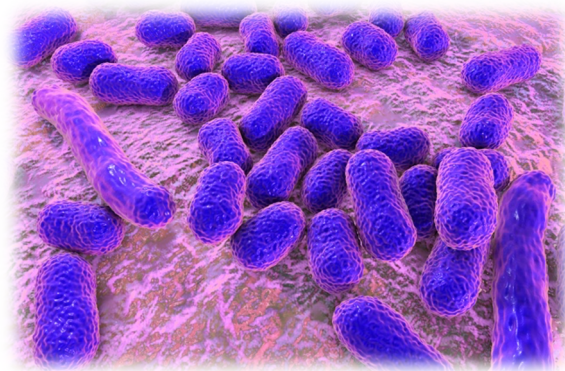
### CleanWhite® 405+470 Antimicrobial White-Illuminating Blue-Light LED Fixtures

Sports-related injuries are common in most athletic programs, from high school and college to professional sports.

Sports-related injuries are usually associated with musculoskeletal, orthopedic, and neurological kinds.

But, athletes and trainers at all levels, most notably in NCAA and professional programs, know something most people don't. Other serious, potentially threatening conditions can occur off the field - in training rooms, locker rooms, showers, and weight rooms.

In the Journal of the American Osteopathic Association, in an evidence-based clinical review<sup>1</sup>It was reported that **athletes contract skin-related infectious diseases at alarming rates.**



The JAOA soberly adds that "Community-acquired MRSA causes substantial morbidity and mortality in athletes." They list risk factors, including "crowded conditions and close contact, compromised skin integrity, uncovered abrasions, shared fomites, suboptimal cleanliness, not showering before pool use...and environment sterilization.

The increasing incidence of bacteria and microbes that are resistant to treatment is related to the ability of bacteria and other microbes to share ARG, or antimicrobial-resistant genes, through a process called Horizontal Gene Transfer, or HRT. ARG microbes have sharply increased due to human and veterinary antibiotic therapy, steroid use for infections, and more complex chemical disinfectants - all of which can result in resistance created by mutations and subsequently shared with other microbes in colonies.

In the NFL, where the financial stakes and public exposure are both high, numerous

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<sup>1</sup> The Journal of the American Osteopathic Association, June 2011, Vol. 111, 373-379.



incidences of MRSA have upset the players and the public and have drawn further attention to the issue.

The NFL and NFL Players Association have worked to better educate players and team staff and issue guidelines on combatting MRSA since it began showing up in the league in the early 2000s.

ESPN staff writer Johnette Howard noted in Why sports can be a breeding ground for dangerous MRSA infections<sup>2</sup> that the problem became so significant that the NFL entered into a consulting arrangement with Duke Infection Control Outreach Network rather than leaving each team on its own to conduct prevention.

Howard tells the story of Brandon Noble, who played for the Dallas Cowboys and Washington Redskins, who battled MRSA for two years and nearly lost his leg to the pathogen.

Noble says that owner, Daniel Snyder, was so distraught over the continuing infections among players that "He basically nuked the building." He ripped out whirlpools and installed ultraviolet lighting (shown to kill MRSA and other germs), and replaced shared benches with individual stools.

## **More than MRSA**

MRSA is hardly the lone pathogen in the locker room and within athletic facilities. A recent independent study<sup>3</sup> by a fitness equipment manufacturer revealed some not-so-surprising results.

(We) "gathered bacteria samples from 27 different pieces of equipment at three different gyms to get an idea of how many germs you may encounter when you touch a treadmill, exercise bike, or free weight."

They found that free weights had 362 times more bacteria on them than a toilet seat. In fact, the number of bacteria on the weights makes a toilet seat almost seem clean by comparison, with 1,158, 381 colony-forming units (CFUs) compared to 3,200 on a toilet.

What's more, they found the same numbers of CFUs (in the millions) among most equipment and surfaces. And the especially pathogenic agents, gram-positive cocci and gram-negative rods, were the most prevalent types of bacteria found.

Looking back at the JAOA study above, these CFU readings exclude the herpes virus and

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<sup>2</sup> [www.espn.com/nfl/story/\\_/id/13896158/cases-new-york-giants-daniel-fells-others-show-danger-mrsa-infections-sports](http://www.espn.com/nfl/story/_/id/13896158/cases-new-york-giants-daniel-fells-others-show-danger-mrsa-infections-sports)

<sup>3</sup> [www.fitrated.com/resources/examining-gym-cleanliness/](http://www.fitrated.com/resources/examining-gym-cleanliness/)



the fungi, which also account for a percentage of conditions/injuries among athletes.

### **A continuous level of disinfection without chemicals**

In addition to rigorous hygiene procedures and disinfecting protocols, the 405+470 surface disinfection technology can now augment an over-arching disinfection and prevention strategy.

It's similar to what Daniel Snyder had in mind – but not quite. Ultraviolet lights do indeed kill MRSA and other bacteria, but they can't be left on continuously, and they don't illuminate. They're harmful to humans in excess exposure.

It's the CleanWhite® 405+470 antimicrobial white-illuminating blue-light LEDs 405nm LED disinfecting light technology that can now make a difference. The LEDs can stay on all the time, and the light wavelength is not harmful to human skin. They emit crisp light spectrums and constantly kill pathogens.

### **The Visible Light Disinfection mechanism**

The CleanWhite® solution eliminates a broad range of surface pathogens as the system continuously creates a hostile environment that helps prevent pathogenic proliferation.

The mechanism proven in clinical studies is a 405+470-nanometer light-induced photodynamic process in which the wavelengths trigger a reaction within the cells and cell walls of the microbes – causing cellular destruction and preventing repopulation.

This 405 and 470-nanometer destruction works on a wide range of prokaryotic and eukaryotic microbial species, including resistant forms such as bacterial and fungal spores. Notably, it kills SARS-CoV-2, MRSA, Pseudomonas, and dangerous mold and fungal species.

The pathogens it has been shown to eliminate include:

#### ESKAPE pathogens

SARS-CoV-2-CoV-2 surrogate – feline calicivirus

Enterococcus faecalis

Staphylococcal Aureus\* (including MRSA)

Klebsiella pneumoniae

Acinetobacter baumannii

Pseudomonas aeruginosa

Enterobacter species

#### Bacterial Endospores

Clostridium difficile (C. diff)

Bacillus cereus

For more information on CleanWhite Disinfection, visit [www.premierss.com/environmental](http://www.premierss.com/environmental)



#### Gram-Positive Bacteria

Clostridium perfringens  
Staphylococcus epidermidis  
Staphylococcus hyicus  
Streptococcus pyogenes  
Listeria monocytogenes  
Mycobacterium terrae  
Corynebacterium striatum

#### Yeast & Filamentous Fungi

Aspergillus niger  
Candida albicans  
Saccharomyces cerevisiae

#### Gram-Negative Bacteria

Proteus vulgaris  
Escherichia coli (E. coli)  
Campylobacter jejuni  
Salmonella enteritidis  
Shigella sonnei

### **CleanWhite's® Breakthrough Technology**

Because the 405+470 nm LED disinfection has never been available in the white illumination spectrum, the potential benefits that always-on disinfection can bring to a broader disinfection and prevention strategy are enormous.

illumPure's CleanWhite® solution includes patented LEDs that emit white light with embedded, spiked 405 and 470 nm energy peaks, which continuously destroy microbes and provide safe disinfection. It can be used 24/7 in occupied rooms – always protecting athletes from harmful, often virulent, and resistant microbes. All surfaces, including permanent surfaces as well as equipment and clothing, are illuminated and receive disinfecting wavelength energies.

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## Addendum

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### Published studies on 405nm photodynamic pathogenic disinfection

1. **Maclean M., et al. 405 nm light technology for the inactivation of pathogens and its potential role for environmental disinfection and infection control**, Journal of Hospital Infection, Volume 88, Issue 1, September 2014, Pages 1–11

*"The trial results have demonstrated that this 405 nm light system can provide continuous disinfection of air and exposed surfaces in occupied areas of the hospital, thereby substantially enhancing standard cleaning and infection control procedures."*

*"405 nm light has significant antimicrobial properties against a wide range of bacterial and fungal pathogens and, although germicidal efficacy is lower than UV light, this limitation is offset by its facility for safe, continuous use in occupied environments."*

2. **Michelle Maclean et al., "A New Proof of Concept in Bacterial Reduction: Antimicrobial Action of Violet-Blue Light (405 nm) in Ex Vivo Stored Plasma"**, J Blood Transfus. Published online 2016 Sep 28 10.1155/2016/2920514 PMID: PMC5059568

3. **A New Proof of Concept in Bacterial Reduction: Antimicrobial Action of Violet-Blue Light (405 nm) in Ex Vivo Stored Plasm**

*Current pathogen reduction technologies (PRT) rely on the use of chemicals and/or ultraviolet light, which affects product quality and can be associated with adverse events in recipients. 405 nm violet-blue light is antibacterial without the use of photosensitizers and can be applied at levels safe for human exposure, making it of potential interest for decontamination utilizes light with a peak wavelength of 405 nm, which causes photoexcitation of endogenous microbial porphyrin molecules and oxidative damage through reactive oxygen species. Overall, this study provides the first evidence that 405 nm light has the ability to inactivate bacterial contamination within biological fluids such as blood plasma. Significant inactivation of microbial contaminants was achieved in plasma samples of varying volumes held in different containers, including prebagged plasma. The penetrability of 405 nm light and the nonrequirement for photosensitizing agents provide this antimicrobial method with unique benefits that could support its further development as a potential alternative to UV light-based system...."*

4. **Journal of Hospital Infection Volume 76, Issue 3, November 2010, Pages 247–251**

*"The ceiling-mounted HINS-light EDS emits high-intensity 405nm light which, although bactericidal, is harmless to patients and staff, thereby permitting*



*continuous environmental disinfection throughout the day. Performance efficacy was assessed by contact agar plate sampling and enumeration of staphylococcal bacteria on environmental surfaces within the room before, during, and after HINS-light EDS treatment. When the room was unoccupied, the use of HINS-light EDS resulted in approx. 90% reduction of surface bacterial levels, and when the room was occupied by an MRSA-infected burns patient, reductions between 56% and 86% were achieved, with the highest reduction (86%) measured following an extended period of HINS-light EDS operation. In an on/off intervention study, bacterial surface levels were reduced by 62% by HINS-light EDS treatment and returned to normal contamination levels two days after the system was switched off. These reductions of staphylococci, including Staphylococcus aureus and methicillin-resistant S. aureus, by HINS-light EDS treatment were greater than the reductions achieved by normal infection control and cleaning activities alone. The findings provide strong evidence that HINS-light EDS, used as a supplementary procedure, can make a significant contribution to bacterial decontamination in clinical environments."*

5. Maclean et al., **"Environmental decontamination of a hospital isolation room using high-intensity narrow-spectrum light...."**
6. Bashe et al., **"Clinical studies of the High-Intensity Narrow-Spectrum light Environmental Decontamination System (HINS-light EDS), for continuous disinfection in the burn unit inpatient and outpatient settings ."** Burns, Volume 38, Issue 1, February 2012, Pages 69-76

*"The High-Intensity Narrow-Spectrum light Environmental Decontamination System (HINS-light EDS) is bactericidal yet safe for humans, allowing continuous disinfection of the environment surrounding burn patients. "The results demonstrate that use of the HINS-light EDS allows efficacious bacterial reductions over and above that achieved by standard cleaning and infection control measures in both inpatient and outpatient settings in the burn unit...."*