

FROST & SULLIVAN

BEST PRACTICES

AWARDS

FROST & SULLIVAN

2020 BEST PRACTICES AWARD

LIGHTSTRIKE™

Pulsed Xenon Disinfection

✕ Powered by XENEX®

**2020 GLOBAL
HEALTHCARE ROOM DISINFECTION DEVICES
COMPANY OF THE YEAR AWARD**

Contents

Background and Company Performance.....	3
<i>Industry Challenges</i>	3
<i>Visionary Innovation & Performance and Customer Impact</i>	4
<i>Conclusion</i>	8
Significance of Company of the Year	9
Understanding Company of the Year	9
<i>Key Benchmarking Criteria</i>	10
Best Practices Recognition: 10 Steps to Researching, Identifying, and Recognizing Best Practices.....	11
The Intersection between 360-Degree Research and Best Practices Awards	12
<i>Research Methodology</i>	12
About Frost & Sullivan.....	12

Background and Company Performance

Industry Challenges

Healthcare-associated infections (HAIs) are a significant global public threat. The COVID-19 pandemic has raised public awareness of disease transmission that can result in deaths and cripple economies. Hospitals have implemented strict cleaning procedures to reduce pathogens within their facilities; however, many processes are ineffective, leaving behind dangerous microorganisms that spread quickly to patients and healthcare workers. Staphylococci, Escherichia coli (E. Coli), Clostridioides difficile (C. diff.), Vancomycin-Resistant Enterococci (VRE), and Pseudomonas aeruginosa are responsible for many infections commonly reported in hospitals.

HAIs are a major contributor to morbidity and mortality in healthcare facilities. According to a study published by the World Health Organization (WHO), HAIs prevalence in Europe is around 7.1%, approximately 4.5 million people affected by HAIs annually, resulting in an estimated 16 million added days of hospital stay and 37,000 additional deaths.¹ Likewise, the WHO indicates that about 1.7 million patients are affected by HAIs annually in the United States (US), accounting for 99,000 deaths per year. With limited data available, it estimates HAIs in low and middle-income countries between 5.7% and 19.1%, with increased length of hospital stay ranging from 5 to 29.5 days.²

Furthermore, the US Centers for Disease Control and Prevention (CDC) determined HAI-associated costs of about \$25,000 per US facility, including treatment, fines, and reputation.³ While still utilizing traditional cleaning practices, hospitals seek effective solutions for killing pathogenic microorganisms in their facilities quickly to enhance patient and employee safety.

In 2007, ultraviolet (UV) room disinfection devices targeted at healthcare facilities entered the market. Many of these systems leverage mercury UV lamps—first developed in the early 1900s. Mercury bulbs, which look like glowing blue fluorescent lamps, run continuously with low intensity. As a result, these devices must run for extended periods, e.g., 52 minutes to deactivate C.diff spores,⁴ and eventually destroy surfaces, equipment, and materials in the rooms where deployed.

Different pathogens are vulnerable to UV light at different wavelengths. While the germicidal spectrum for UV light is 200 to 315 nanometers (nm), includes UVC and UVB light, mercury bulbs broadcast UV light at a single frequency, 253.7nm—making the mercury UV devices inefficient at killing many HAI-causing pathogens. Using mercury bulbs, some UV manufacturers market their devices as UVC as they fall within the 200 to 280 nm range.

Many UV room disinfection devices use mercury bulbs; thus, very little differentiation exists between mercury UV solutions and their manufacturers. Competitors in the market often claim that

¹ WHO. Report on the burden of endemic Health Care-Associated Infection Worldwide. WHO. 2011

².Ibid

³ Scott, R. D. (2009). The direct medical costs of healthcare-associated infections in US hospitals and the benefits of prevention. National Center for Preparedness, Detection, and Control of Infectious Diseases (U.S.), Division of Healthcare Quality Promotion.

⁴ [https://www.thelancet.com/journals/lancet/article/PIIS0140-6736\(16\)31588-4/fulltext](https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(16)31588-4/fulltext)

their robot will disinfect high touch surfaces—objects like remote controls and nurse call buttons that can transfer pathogens to a person—in a single pass, seeking to differentiate their offerings. Nonetheless, the reality is that UV light does not treat the underside of objects in a single pass, leaving behind dangerous bioburden. As pathogens exist on the entire surface, objects require turning, flipping, and opening to ensure the light from the UV room disinfection device reaches the whole surface.

Recent interest in autonomous disinfection robot technology also fails to complete the task at hand. These robots (many of which utilize mercury UV light) are only capable of disinfecting approximately 9 rooms per day on a single charge and leave behind bioburden on high touch surfaces not exposed to the light. Far-UV has been receiving attention as of late; however, several published articles state needing more research to ensure that direct, Far-UV exposure to humans is safe.⁵

Visionary Innovation & Performance and Customer Impact

Founded in 2009 by infectious disease epidemiologists Dr. Julie Stachowiak and Dr. Mark Stibich, Xenex aims to change the face of the UV room disinfection industry. The company's patented pulsed xenon UV light creates a new standard of care for HAI reduction in terms of efficacy, safety, and efficiency.

Xenex is the world leader in UV disinfection for healthcare facilities and is the global industry standard for effective, safe, and fast UV room disinfection. More than 650 healthcare facilities worldwide use the company's LightStrike robots for room disinfection, including acute care hospitals, long-term care facilities, outpatient surgery centers, nursing homes, and medical office buildings.

As a result of the COVID-19 pandemic and the world's focus on preventing disease transmission, organizations outside of healthcare are quickly adopting Xenex's robots for disinfection, including hotels, government buildings, schools, professional sports facilities, police stations, pharmaceutical cleanrooms, and food processing facilities.

LightStrike™ Germ-Zapping Robots: Groundbreaking Innovation

Powered by high intensity, broad-spectrum UV light generated by a xenon lamp, Xenex's LightStrike Germ-Zapping Robot provides unique and unmatched capabilities within the UV disinfection robot market.

Unlike mercury-bulb (253.7nm) systems, Xenex's robot broadcasts UV light across the entire germicidal spectrum—200 to 315 nanometers. It delivers high intensity to penetrate microorganism cell walls, consequently, causing irreparable damage faster and more effectively than mercury bulb powered devices.

⁵<https://iuva.org/resources/covid-19/Far%20UV-C%20in%20the%20200%20%20225%20nm%20range,%20and%20its%20potential%20for%20disinfection%20applications.pdf>

The picture to the right depicts a third-party comparison test showing significant cellular damage and lysis with a pulsed xenon lamp versus no detected cellular damage by exposing to the mercury lamp under the same conditions.

A study conducted by South Seminole Hospital (Orlando Health) reported an 87% reduction in VRE infection rates in the intensive care unit (ICU) after using LightStrike robots for room disinfection. The hospital found the combined VRE, MRSA, and C. diff infection rates dropped by 61% in ICU and 29% facility-wide, resulting in 390 bed days generated and \$730,000 in savings.⁶

LightStrike™ Germ-Zapping™ Robot



Beyond destroying microorganisms effectively, the high-intensity pulsed xenon UV light operates more quickly than other UV technologies. For example, the LightStrike robot runs an average of 5 minutes to deactivate C.diff spores compared to mercury bulbs requiring a 52-minute run time.

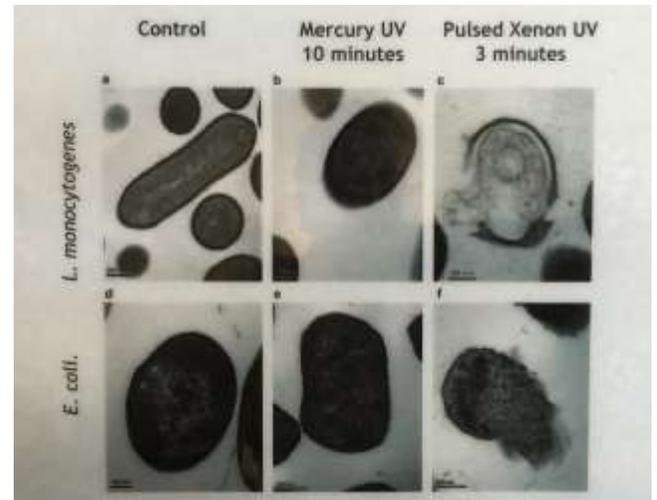
Furthermore, LightStrike robots do not require warm-up and cool-down time; hence, they can disinfect an entire patient room in the same time it takes for an autonomous robot to begin its disinfection process.

Xenex designed its LightStrike Germ-Zapping Robots to run 5-minute cycles, despite killing most pathogens in 2 minutes—i.e., VRE, MRSA, E. Coli, Ebola, SARS-CoV-2, and Pseudomonas aeruginosa. These devices can destroy C. diff, the hardest pathogen to kill, in a five-minute cycle. In a typical patient room, the robot runs a 5-minute cycle in 3 different locations: Two areas in the room (to ensure disinfection of each side of an

object) and one cycle in the restroom.

Xenex's LightStrike Germ-Zapping Robots can decontaminate up to 65 rooms per day, according to hospitals using the robots. A study published in the American Journal of Infection Control by the Mayo Clinic showed a 47% reduction in C. diff infection rates after adding the LightStrike robots to the facility's cleaning protocols.

Intense pulsed light- and UVC-induced cell damage in *Listeria monocytogenes* and *E. Coli*



<https://www.sciencedirect.com/science/article/abs/pii/S0956713511005147>

⁶ Vianna, Pedro G., et al. "Impact of Pulsed Xenon Ultraviolet Light on Hospital-Acquired Infection Rates in a Community Hospital." *American Journal of Infection Control*, vol. 44, no. 3, 2016, pp. 299–303., doi:10.1016/j.ajic.2015.10.009.

As C. diff infections can result in an average of 3 extra hospital days for the affected patient, the health center realized a substantial return on investment (ROI) upon deploying Xenex's devices when comparing the increased length of stay versus the slight increase in cleaning time.⁷

The LightStrike Germ-Zapping Robots do not damage surface materials⁸ and have safely run more than 24 million cycles.

Safeguarding Quality Studies, Proven Value

Xenex is an evidence-based company focused on providing customers with high-quality solutions to reduce HAIs. Built on science, Xenex's claims are backed up by scientifically-driven, peer-reviewed publications. Moreover, the company does not pay health centers for the studies published, ensuring data quality and integrity through a non-biased, qualified third-party.

After implementing Xenex's systems and recommended protocols, health centers often conduct objective comparative studies on their HAI rates. To date, the company has 35 peer-reviewed studies validating the efficacy of its LightStrike Germ-Zapping Robots, including 12 outcome studies highlighting infection rate reductions hospitals realized after incorporating LightStrike robots into their protocols for room disinfection. Notably, a study by Westchester Medical stated a 70% decrease of HAIs in the adult ICU, along with a decreased length of hospital stay.⁹ At Trinity Medical Center—a 534-bed community healthcare provider, Xenex's devices disinfected rooms where patients were recovering from hip surgery. The facility reported a 100% reduction in total joint surgical site infections over 12 months, leading to \$290,900 in savings, 1 death prevention, and 7 infections avoided.¹⁰

Peer-reviewed studies published in scientific journals are the gold standard for assessing new healthcare technologies. Xenex is the only UV disinfection technology provider with multiple hospitals publishing statistically significant infection rate reduction studies in peer-reviewed journals, an important factor setting it apart from its competitors who lack scientific evidence.

Customer Success Guarantee

Xenex guarantees its customers HAI reduction and ROI and designs its purchase process with this in mind. The company has placed robots in hospitals without billing the hospital until it experienced reductions in its infection rates that exceeded 50%. Through this strategy, hospitals experience Xenex's systems value firsthand.

⁷ Sampathkumar, Priya, et al. "A trial of pulsed xenon ultraviolet disinfection to reduce *Clostridioides difficile* infection" *American Journal of Infection Control*, vol 47, no. 4, 1 Apr. 2019, pp. 406-408 <https://doi.org/10.1016/j.ajic.2018.09.018>

⁸ "Executive Briefing: How 2 Hospitals Used Pulsed Xenon UV Disinfection to Slash HAI Rates." *Becker's Hospital Review*, Becker's Healthcare, www.beckershospitalreview.com/quality/executive-briefing-how-2-hospitals-used-pulsed-xenon-uv-disinfection-to-slash-hai-rates.html

⁹ Nagaraja, Aarathi, et al. "Clostridium Difficile Infections before and during Use of Ultraviolet Disinfection." *American Journal of Infection Control*, vol. 43, no. 9, 1 Sept. 2015, pp. 940-945., doi:10.1016/j.ajic.2015.05.003.

¹⁰ Fornwalt, Lori, et al. "Influence of a Total Joint Infection Control Bundle on Surgical Site Infection Rates." *American Journal of Infection Control*, vol. 44, no. 2, 2016, pp. 239-241., doi:10.1016/j.ajic.2015.09.010.

While mercury bulb UV systems are less expensive regarding acquisition cost, these devices are also less effective; thus, the cost per room disinfection is higher when factoring in the number of rooms per day disinfected with the LightStrike technology. Many hospitals purchase mercury bulb disinfection systems without understanding their suboptimal performance. Xenex offers a trade-in program for customers, where it will replace the ineffective disinfection systems with LightStrike technology to allow hospitals to experience the speed and efficacy of its devices.

The company understands the necessity of supporting customers to experience the highest ROI. Upon new customer acquisition, Xenex team members go onsite to train hospital staff on how the robots work, how and when to use them, and how to monitor and analyze utilization data, streamlining the use case and experience the highest ROI. Xenex inputs the hospital's room configurations into the robot's system via a user-friendly customer portal and ensures all facility information is adequately fielded and uploaded to the cloud.

The company's UV light robots collect multiple parameters—including room type, location, run time, area within the room, the operator who ran it—and uploads the data to a cloud-based portal. The solution allows the hospital to track HAI infection rates, analyze the system's efficacy, and identify gaps in workflows.

Xenex's ongoing innovation continuously exceeds the customer's needs in various applications. The company helps hospitals create use protocols, such as running the robot for 2 minutes between surgeries after manual cleaning in operating rooms to reduce pathogens further. As a result, it creates the largest possible value for customers in a variety of health settings.

Customer-centric Aligned Goals

Xenex focuses not just on selling products, but on solving issues for hospitals. Combined with its unique value proposition, the company currently maintains about 55% of the global healthcare UV disinfection solutions market.

Its systems have been successfully deployed internationally, with robots utilized in Asia, Canada, Europe, the US, Middle East, Africa, and South America. Xenex is the first and only UV room disinfection technology proven to deactivate SARS-CoV-2, the virus that causes COVID-19. The LightStrike robot achieved a >99.99% level of disinfection against SARS-CoV-2 in 2 minutes.

However, as over 1.4 million people experience a HAI annually in the US alone—averaging 100,000 deaths per year, the company will continue to gain market share as hospitals increasingly recognize its systems' value—both in terms of improved patient care and economics.

Xenex holds more than 115 patents on its technology, with over 75 patents pending, cementing its leadership position within the healthcare disinfection market. Frost & Sullivan believes that Xenex is well-poised for continuing and rapid market growth.

Conclusion

Healthcare-associated infections are a major threat to public health worldwide, as evidenced by the ongoing COVID-19 pandemic. Most ultraviolet (UV) disinfection systems rely on mercury UV bulbs to kill pathogens; however, these devices only broadcast at a single wavelength, 253.7 nanometers, with low intensity. These solutions are slow and ineffective at helping hospitals reduce infection rates without damaging equipment, surfaces, and materials in the rooms.

Powered by its patented technology, broadcasting intense UV light across the entire germicidal spectrum, Xenex's proprietary LightStrike Germ-Zapping Robots destroy even the most challenging pathogen, i.e., *Clostridioides difficile*, in a 5-minute cycle. As a result, Xenex's customers can disinfect dozens of rooms per day and experience a high return on investment, including infection rate reductions of 70% to 100%, decreased length of hospital stay, lowered treatment costs—by thousands of dollars per patient—and, most importantly, many saved lives. Xenex is the only UV disinfection company with multiple hospitals publishing peer-reviewed studies validating their significant reductions in infection rates after using LightStrike robots for room disinfection.

For its strong overall performance, Xenex is recognized with Frost & Sullivan's 2020 Global Company of the Year Award in the healthcare room disinfection devices industry.

Significance of Company of the Year

To receive the Company of the Year Award (i.e., to be recognized as a leader not only in your industry, but among non-industry peers) requires a company to demonstrate excellence in growth, innovation, and leadership. This excellence typically translates into superior performance in three key areas—demand generation, brand development, and competitive positioning—that serve as the foundation of a company’s future success and prepare it to deliver on the 2 factors that define the Company of the Year Award: Visionary Innovation and Performance, and Customer Impact).



Understanding Company of the Year

Driving demand, brand strength, and competitive differentiation all play critical roles in delivering unique value to customers. This three-fold focus, however, must ideally be complemented by an equally rigorous focus on Visionary Innovation and Performance to enhance Customer Impact.

Key Benchmarking Criteria

For the Company of the Year Award, Frost & Sullivan analysts independently evaluated two key factors—Visionary Innovation & Performance and Customer Impact—according to the criteria identified below.

Visionary Innovation & Performance

Criterion 1: Addressing Unmet Needs

Requirement: Implementing a robust process to continuously unearth customers' unmet or under-served needs, and creating the products or solutions to address them effectively

Criterion 2: Visionary Scenarios through Mega Trends

Requirement: Incorporating long-range, macro-level scenarios into the innovation strategy, thereby enabling "first-to-market" growth opportunity solutions

Criterion 3: Implementation of Best Practices

Requirement: Best-in-class strategy implementation characterized by processes, tools, or activities that generate a consistent and repeatable level of success.

Criterion 4: Blue Ocean Strategy

Requirement: Strategic focus on creating a leadership position in a potentially "uncontested" market space, manifested by stiff barriers to entry for competitors

Criterion 5: Financial Performance

Requirement: Strong overall business performance in terms of revenues, revenue growth, operating margin, and other key financial metrics

Customer Impact

Criterion 1: Price/Performance Value

Requirement: Products or services offer the best value for the price, compared to similar offerings in the market.

Criterion 2: Customer Purchase Experience

Requirement: Customers feel they are buying the most optimal solution that addresses both their unique needs and their unique constraints.

Criterion 3: Customer Ownership Experience

Requirement: Customers are proud to own the company's product or service and have a positive experience throughout the life of the product or service.

Criterion 4: Customer Service Experience

Requirement: Customer service is accessible, fast, stress-free, and of high quality.

Criterion 5: Brand Equity

Requirement: Customers have a positive view of the brand and exhibit high brand loyalty.

Best Practices Recognition: 10 Steps to Researching, Identifying, and Recognizing Best Practices

Frost & Sullivan analysts follow a 10-step process to evaluate Award candidates and assess their fit with select best practice criteria. The reputation and integrity of the Awards are based on close adherence to this process.

STEP	OBJECTIVE	KEY ACTIVITIES	OUTPUT
1 Monitor, target, and screen	Identify Award recipient candidates from around the globe	<ul style="list-style-type: none"> • Conduct in-depth industry research • Identify emerging sectors • Scan multiple geographies 	Pipeline of candidates who potentially meet all best-practice criteria
2 Perform 360-degree research	Perform comprehensive, 360-degree research on all candidates in the pipeline	<ul style="list-style-type: none"> • Interview thought leaders and industry practitioners • Assess candidates' fit with best-practice criteria • Rank all candidates 	Matrix positioning of all candidates' performance relative to one another
3 Invite thought leadership in best practices	Perform in-depth examination of all candidates	<ul style="list-style-type: none"> • Confirm best-practice criteria • Examine eligibility of all candidates • Identify any information gaps 	Detailed profiles of all ranked candidates
4 Initiate research director review	Conduct an unbiased evaluation of all candidate profiles	<ul style="list-style-type: none"> • Brainstorm ranking options • Invite multiple perspectives on candidates' performance • Update candidate profiles 	Final prioritization of all eligible candidates and companion best-practice positioning paper
5 Assemble panel of industry experts	Present findings to an expert panel of industry thought leaders	<ul style="list-style-type: none"> • Share findings • Strengthen cases for candidate eligibility • Prioritize candidates 	Refined list of prioritized Award candidates
6 Conduct global industry review	Build consensus on Award candidates' eligibility	<ul style="list-style-type: none"> • Hold global team meeting to review all candidates • Pressure-test fit with criteria • Confirm inclusion of all eligible candidates 	Final list of eligible Award candidates, representing success stories worldwide
7 Perform quality check	Develop official Award consideration materials	<ul style="list-style-type: none"> • Perform final performance benchmarking activities • Write nominations • Perform quality review 	High-quality, accurate, and creative presentation of nominees' successes
8 Reconnect with panel of industry experts	Finalize the selection of the best-practice Award recipient	<ul style="list-style-type: none"> • Review analysis with panel • Build consensus • Select winner 	Decision on which company performs best against all best-practice criteria
9 Communicate recognition	Inform Award recipient of Award recognition	<ul style="list-style-type: none"> • Present Award to the CEO • Inspire the organization for continued success • Celebrate the recipient's performance 	Announcement of Award and plan for how recipient can use the Award to enhance the brand
10 Take strategic action	Upon licensing, company able to share Award news with stakeholders and customers	<ul style="list-style-type: none"> • Coordinate media outreach • Design a marketing plan • Assess Award's role in future strategic planning 	Widespread awareness of recipient's Award status among investors, media personnel, and employees

The Intersection between 360-Degree Research and Best Practices Awards

Research Methodology

Frost & Sullivan's 360-degree research methodology represents the analytical rigor of our research process. It offers a 360-degree view of industry challenges, trends, and issues by integrating all 7 of Frost & Sullivan's research methodologies. Too often companies make important growth decisions based on a narrow understanding of their environment, leading to errors of both omission and commission. Successful growth strategies are founded on a thorough understanding of market, technical, economic, financial, customer, best practices, and demographic analyses. The integration of these research disciplines into the 360-degree research methodology provides an evaluation platform for benchmarking industry participants and for identifying those performing at best-in-class levels.

360-DEGREE RESEARCH: SEEING ORDER IN THE CHAOS



About Frost & Sullivan

Frost & Sullivan, the Growth Partnership Company, enables clients to accelerate growth and achieve best-in-class positions in growth, innovation, and leadership. The company's Growth Partnership Service provides the CEO and the CEO's Growth Team with disciplined research and best practice models to drive the generation, evaluation, and implementation of powerful growth strategies. Frost & Sullivan leverages more than 50 years of experience in partnering with Global 1000 companies, emerging businesses, and the investment community from 45 offices on six continents. To join our Growth Partnership, please visit <http://www.frost.com>.