

A COST ANALYSIS OF CHEMICAL DISINFECTION PER ROOM-SPACE TYPES WITHIN CERTAIN MARKET RISK CHANNELS FOR COMPARATIVE RETURN ON INVESTMENT CONSIDERATIONS

ABSTRACT

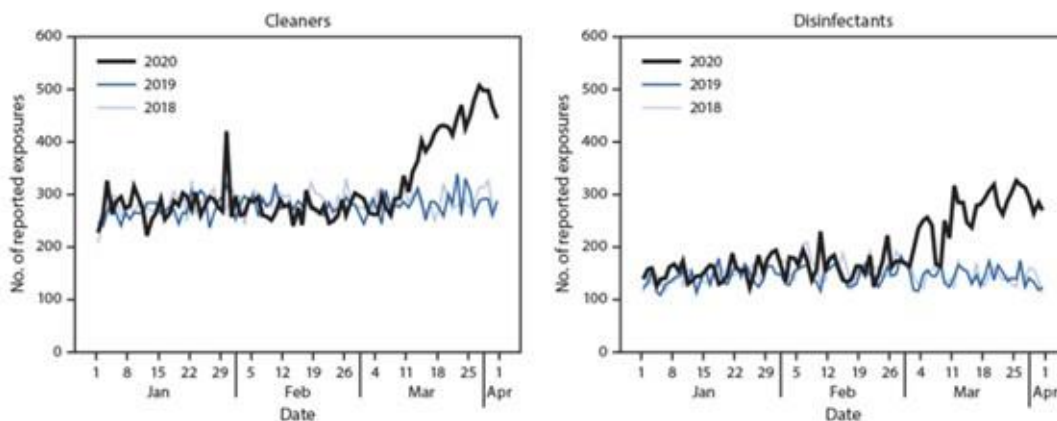
Numerous infectious diseases, including COVID-19, are transmitted by airborne and surface pathogens. There is a demand for cost effective environmental control protocols which, ideally, are not reliant on human behavior. One potential solution is Krypton Chloride (KrCl) excimer lamps (often referred to as 222nm or Far-UV-C), which can efficiently inactivate pathogens, such as coronaviruses and influenza. The following analysis looks at the “hands-on” annual chemical room costs for comparison to capital equipment costs to estimate return on investment for safe and effective in-room devices that contain 222nm or Far-UV-C technologies.

BACKGROUND: The current state of chemical-based disinfection to reduce risks in pathogen heightened environments has additive costs and hazardous propositions to business in every increasing ecosystem conscience societies. Manual disinfection methods involve liquid chemical mixing, and applications using spay and wiping protocols. Reported (to U.S. poison centers, (Figure below) daily exposure to chemicals and disinfectants has seen dramatic increases beginning in January, 2020. The long-term health consequences are likely to result in respiratory issues, skin and eye damage in both normal and compromised respiratory patients with COPD, asthma and other progressive lung diseases. The liability of worker related illness due to hazardous chemicals is a likely cost consequence of chemical-based disinfections applications.

METHODS: Using chemical based institutional type protocols room / space was categorized by room type and usage. A three-tiered risk level assignment was applied to each room / space based on likely occupancy rates, air volume per room and medical safety risk. An average square footage was assumed for each room / space type and an average time in minutes was assigned based on research around suggested liquid chemical cleaning time period protocols. A custodial burdened hourly rate was assigned and the square footage to time (in minutes) was estimated for each room / space type. A cost per square foot was calculated **to determine additional cost over standard cleaning room cost**. The annual cost per room / space type was then calculated based on frequency of cleaning per week, over a 52-week period (1 year period).

RESULTS:

FIGURE. Number of daily exposures to cleaners and disinfectants reported to U.S. poison centers — United States, January–March 2018, 2019, and 2020*.[†]



* Excluding February 29, 2020.

[†] Increase in exposures to cleaners on January 29, 2020, came from an unintentional exposure to a cleaning agent within a school.

The following table provides the category of room / space types with assigned cleaning / risk levels based on likely occupancy rates, air volume per room and medical safety risk, estimate of sq footage per room/ space, a burdened custodial labor rate , **time to chemically disinfect surfaces only**, estimate of cost per square foot per room / space type, estimate of individual room / space disinfection cost, frequency of chemical cleaning per week, estimated annual cost per room / space for a 52-week period with a frequency of three disinfection cleaning assumed per week.

PER YEAR COST-ANALYSIS OF DISIFECTION USING CHEMICAL CLEANING PROCESSES PER SPACE / ROOM TYPE									
ROOM / SPACE TYPE	CLEANING / RISK LEVEL(S)	Chemical Cost per Sq Ft. **	Square Footage of Space	Rate per hours \$	Time (minutes) estimates to clean surface ***	Cost Per Square footage	Cost based on Cleaning Risk Factors (per room)	Frequency of chem-cleaning per week	Cost per Year per Room type (52 weeks)
General medical, dental, schools classroom, patients rooms, etc.	1	\$ 0.038	500	\$20.00	35	\$ 0.061	\$ 45.96	3	\$ 7,170.15
Computer room, front office etc.	1	\$ 0.038	1000	\$20.00	25	\$ 0.046	\$ 69.43	3	\$ 10,830.30
Conference rooms	1	\$ 0.038	1000	\$20.00	25	\$ 0.046	\$ 69.43	3	\$ 10,830.30
Small lunchroom, breakrooms,	1	\$ 0.038	400	\$20.00	25	\$ 0.059	\$ 35.27	3	\$ 5,502.12
Office, shared workspace	1	\$ 0.038	750	\$20.00	25	\$ 0.049	\$ 55.19	3	\$ 8,610.23
Large public space common area	2	\$ 0.038	1500	\$20.00	35	\$ 0.046	\$ 68.59	3	\$ 10,700.30
Smaller common areas	1	\$ 0.038	350	\$20.00	20	\$ 0.057	\$ 29.92	3	\$ 4,668.11
Dining rooms	1	\$ 0.038	1000	\$20.00	40	\$ 0.051	\$ 76.93	3	\$ 12,000.30
Laboratories	2	\$ 0.038	1000	\$20.00	30	\$ 0.048	\$ 47.95	3	\$ 7,480.20
Libraries, other large room gathering space	2	\$ 0.038	2000	\$20.00	45	\$ 0.045	\$ 90.90	3	\$ 14,180.40
Restrooms	1	\$ 0.038	750	\$20.00	40	\$ 0.045	\$ 51.13	3	\$ 7,976.48
Equipment, vehicles, tools, material handing	3	\$ 0.038	100	\$20.00	10	\$ 0.07	\$ 3.56	3	\$ 556.01

** Chemical sq ft. cost is arrived based on gallon cost of Vital Oxide at \$37.95 per gallon with a 1000 square foot coverage estimate based on spray bottle type application

*** The Association for Health Care Environmental recommends **hospitals set 35 minutes to an hour** for terminal cleaning. According to published research conducted at 36 acute care hospitals, over 50% of the commonly touched surfaces in patient rooms were missed during liquid chemical cleaning process¹. Additional research identified that time spent cleaning with liquid chemical beyond **25 minutes did not significantly reduce** the bacteria on commonly touched surfaces². Pathogens missed during the cleaning / disinfection process have led to transmission by hand³.

OTHER COSTS CONSIDERATIONS NOT REFLECTED IN ABOVE MODELS:

- Training and on-boarding estimated at two days at \$288 per person
- Response to a Covid-19 positive individual estimated at three days per room at highest cleaning cost (\$63.00 Per Room) or \$189 per room plus administration cost of \$250 per incident. The total chem-cleaning cost per room with administrative cost over 3 days: \$439.
- Cost of manual history record retention, documentation estimated at 15 -30 minutes per room at \$25.00 per hr. administrative labor cost x 3 records per week x 52 weeks per yr. cost range \$975 to \$1,950 (per room).
- Cost for capital equipment for spray application tools are estimated at 1) Electrostatic hand sprayer \$700, Electrostatic spray backpack \$1,750.

CONSLUIONS: The hazardous chemical risk, high repeating labor cost, increased number of poison center calls and unknown long-term worker illness liabilities suggest there is a demand for less exposure to harmful chemicals. One such disinfection method appears to be the safe and effective, 222nm UVC disinfection devices that can both sterilize air and surfaces while monitoring and recording facility history events seamlessly.

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FOOTNOTES:

1. Carling P: Improving Cleaning of the Environment Surrounding Patients in 36 Acute Care Hospitals. Am J Infect Control 2008, vol. 29:11, pp 1035-1041
2. Coppin JD, et al. ICHE. 2019;40(5):605-6
3. Dancer SJ. JHI. 2009;73(4):378-85