Urrutia AR, et al., J Gerontol Geriatr Med 2023, 9: 177
DOI: 10.24966/GGM-8662/100177

HSOA Journal of Gerontology and Geriatric Medicine

Short commentary

Clinical and Economic Outcomes from the Installation of an Advanced Air Purification Technology in a Long Term Care Facility

Urrutia AR[1]*, Eid S[2], Bock KA[3] and Worrilow KC[1]

[1]*LifeAire Systems, Allentown, PA, USA*

[2]*Sherrine Eid Consulting, Macungie, PA, USA*

[3]*Phoebe Ministries Allentown, Allentown, PA, USA*

Abstract

This study, originally published in the Journals of Gerontology: Medical Sciences, aimed to assess the effectiveness of an Advanced Air Purification Technology (AAPT) in reducing airborne contaminants and improving clinical outcomes in long-term care facilities (LTCFs). With the increasing aging population, the demand for LTCFs is rising, highlighting the importance of indoor air quality. Current infection prevention programs in LTCFs often overlook airborne pathogens, which constitute a significant portion of all infection-causing pathogens. Respiratory diseases pose a significant risk to older adults with compromised respiratory systems. Volatile organic compounds (VOCs) found in indoor air contribute to pulmonary impairment, making comprehensive remediation of airborne contaminants essential. The AAPT, which combines VOC filters, high-dose ultraviolet germicidal irradiation (UVGI), and high efficiency particulate air (HEPA) filtration, was developed to provide ultra-pure air without harmful byproducts. The study compared the AAPT to standard HEPA filtration in a LTCF over a 15-month period. Environmental testing analyzed VOC levels, airborne and surface pathogens. Statistical analyses were conducted to assess the impact of the AAPT on environmental and clinical metrics. The study demonstrated a significant reduction in airborne pathogens (98.83%) and VOC levels (89.88%) after AAPT installation. Notably, the study reported a 39.6% reduction in HAIs and a 47% decrease in staff call-outs on the study floor. These positive outcomes enhance resident wellness, safety and provide economic benefits for LTCFs. The study emphasizes the significance of high-quality air purification and highlights the novel application of the AAPT in LTCF settings. The AAPT's effectiveness makes it a promising solution for improving indoor air quality in LTCFS. Further research is warranted to explore its application in different LTCF environments. Overall, the study demonstrates the potential of AAPT to improve infection control practices and resident outcomes in LTCFs with broader implications for the field.

Keywords: HAI; HVAC; Infection; Long-term care; Pathogen; VOC

***Corresponding author:** Urrutia AR, LifeAire Systems, Allentown, PA, USA, Tel: +1 4842243042; E-mail: aurrutia@lifeaire.com

Citation: Urrutia AR, Eid S, Bock KA, Worrilow KC (2023) Clinical and Economic Outcomes from the Installation of an Advanced Air Purification Technology in a Long Term Care Facility. J Gerontol Geriatr Med 9: 177.

Received: June 13, 2023; **Accepted:** June 29, 2023; **Published:** July 06, 2023

Introduction

As of 2022, the United States has 55.6 million people aged 65 and older, accounting for 16.9% of the total population [1]. This number is expected to reach 94.7 million by 2060 [2,3]. With the aging population, the demand for long-term care facilities (LTCFs) is increasing. Approximately 2.1 million people in the United States live in LTCFs, including over 1.2 million nursing home residents [2,4,5]. Indoor air quality in LTCFs is crucial due to its impact on healthcare-associated infections (HAIs) [4,6,7]. Older adults in LTCFs are susceptible to HAIs due to age-related factors and facility-related factors [8-10]. Within the nursing home population alone, there are an estimated 1.13 to 2.68 million infections [11]. Infection prevention and control programs in LTCFs primarily focus on hand hygiene, respiratory tract infection prevention, surface cleaning, personal protective equipment, training, and education [12]. However, these programs often overlook airborne pathogens, despite 69-80% of all infection-causing pathogens being airborne [13].

Respiratory diseases affect 10% of the U.S. population aged 65 and older, leading to decreased lung function and increased mortality [2,14,15]. Volatile organic compounds (VOCs) commonly found in indoor air contribute to pulmonary impairment, which is particularly risky for older adults with compromised respiratory systems [16,17]. An Advanced Air Purification Technology (AAPT), using a five-stage system, was developed to comprehensively remediate airborne contaminants, including VOCs and pathogens [18]. The AAPT, which is installed in the facility's heating, cooling, and air conditioning (HVAC) system, combines proprietary VOC filters, a high-dose ultraviolet germicidal irradiation (UVGI) chamber, and HEPA filtration to provide contaminant free air on a single pass through the system. It does not produce harmful byproducts or ozone.

The goal of the study was to assess the impact of AAPT compared to HEPA filtration only. The comprehensive remediation of airborne contaminants by the AAPT was expected to reduce pathogen load, VOC levels, and the rate of illness and infection in LTCFs.

Materials and Methods

This study was originally published in the Journals of Gerontology: Medical Sciences with the title "The Effects of an Advanced Air Purification Technology on Environmental and Clinical Outcomes in a Long-Term Care Facility" [19]. The study was conducted at a LTCF to assess the impact of an AAPT on environmental and clinical outcomes compared to standard HEPA filtration. The Institutional

Review Board approved the study, and the AAPT was retrofitted onto the facility's rooftop. Two air filtration zones were evaluated on two different resident floors over a 15-month period. The control floor had only HEPA filtration, while the study floor had AAPT remediation and HEPA filtration. The physical layout, construction materials, and contractors were identical for both floors. Staff and residents were blinded to the study.

Environmental testing was conducted at five locations on both floors, including resident rooms, dining areas, and community areas. VOC canister testing, airborne fungal and bacterial sampling, and surface sampling from commonly touched surfaces were performed at each location. Additional airborne fungal and bacterial sampling was conducted in the bathroom of resident rooms. The biological airborne and swab samples were analyzed by a third-party laboratory using proprietary methods. Viable bacteria and fungi were quantified and identified. The VOC load in each room was measured using the EPA TO-15 methodology.

Statistical analyses, such as paired t-tests, one-way analysis of variance, and nonparametric tests, were used to assess pre- and post-installation differences in airborne and surface metrics, as well as clinical data. The study included all residents and staff on both floors, with no exclusions. Adjusted odds ratios and 95% confidence intervals were calculated, and SPSS 24.0 (IBM, Armonk, NY) software was used for data analysis.

Results and Discussion

The previously published study analyzed the clinical and environmental data from of the control floor and study floor to assess the effectiveness of an AAPT in reducing pathogens and improving clinical outcomes [19]. The demographics of the control and study floor were comparable, showing that the two floors were equivalent and suitable for statistical comparisons. The analysis of the environmental results showed a significant reduction in airborne pathogens (98.83%) and VOC levels (89.88%) after the installation of the AAPT, as compared to pre-installation values. The study floor demonstrated a substantial decrease in both airborne and surface pathogen loads compared to the control floor. The reduction in surface pathogens was attributed to the decreased pathogen load in the air. The study revealed a 39.6% reduction in HAIs on the study floor compared to the control floor. Additionally, a retrospective evaluation demonstrated a 53.5% reduction in HAIs on the study floor pre- vs. post-installation. The study also found a significant decrease in staff call-outs of 47%.

By removing/reducing two common vectors if illness, infectious airborne and surface pathogens, over HEPA filtration, the AAPT drove reductions in HAIs and staff illness. These positive clinical outcomes translate to improved resident wellness and safety, as well as economic benefits for the LTCF. The reduction in HAIs increases the facility's reimbursement rates and improves its overall ranking. The study emphasized the importance of high-quality air purification in LTCFs and highlighted the novel application of the AAPT in pathogen and VOC remediation. The AAPT's effectiveness is not reliant on human intervention, in contrast to hand hygiene and surface cleaning practices, which can vary in effectiveness due to compliance and technique. The study concluded that the AAPT is an effective solution for reducing airborne contaminants and improving indoor air quality in LTCFs, with potential for broader application and further research in different LTCF environments [19].

Acknowledgement

The advanced air purification technology was provided to Phoebe Ministries Allentown through a nonmonetary grant by LifeAire Systems. Date of award: August 2018. The study conduct and data verification occurred independently.

References

1. America's Health Rankings United Health Foundation (2022) 2022 Senior Report. America's Health Rankings United Health Foundation, USA.
2. The Administration for Community Living (2021) Profile of Older Americans. ACL, USA.
3. The Administration for Community Living (2020) Profile of Older Americans. ACL, USA.
4. Smith PW, Bennett G, Bradley S, Drinka P, Lautenbach E, et al. (2008) Shea/APIC guideline: Infection prevention and control in the long-term care facility. Am J Infect Control 36: 504-535.
5. Thomeer MB, Mudrazija S, Angel JL (2016) Relationship Status and Long-Term Care Facility Use in Later Life. The Journals of Gerontology Series B: Psychological Sciences and Social Sciences 71: 711-723.
6. Wu MJ, Feng YS, Sung WP, Surampalli RY (2011) Quantification and Analysis of Airborne Bacterial Characteristics in a Nursing Care Institution. J Air Waste Manag Assoc 61: 732-739.
7. Nicolle LE (2000) Infection Control in Long-Term Care Facilities. Clinical Infectious Diseases 31: 752-756.
8. van Buul LW, van der Steen JT, Veenhuizen RB, Achterberg WP, Schellevis FG, et al. (2012) Antibiotic Use and Resistance in Long Term Care Facilities. J Am Med Dir Assoc 13: 568.
9. Nicolle LE, Strausbaugh LJ, Garibaldi RA (1996) Infections and Antibiotic Resistance in Nursing Homes. Clin Microbiol Rev 9: 1-17.
10. Siegel JD, Rhinehart E, Jackson M, Chiarello L (2007) 2007 guideline for isolation precautions: preventing transmission of infectious agents in health care settings. Am J Infect Control 35: 65-164.
11. Herzig CTA, Dick AW, Sorbero M, Pogorzelska-Maziarz M, Cohen CC, et al. (2017) Infection Trends in US Nursing Homes, 2006-2013. J Am Med Dir Assoc 18: 635.
12. Lee MH, Lee GA, Lee SH, Park YH (2019) Effectiveness and core components of infection prevention and control programmes in long-term care facilities: A systematic review. J Hosp Infect 102: 377-393.
13. Kowalski W (2012) Hospital Airborne Infection Control. CRC Press, Boca Raton, USA.
14. Tantucci C, Modina D (2012) Lung function decline in COPD. Int J Chron Obstruct Pulmon Dis 7: 95-99.
15. Sin DD, Anthonisen NR, Soriano JB, Agusti AG (2006) Mortality in COPD: role of comorbidities. Eur Respir J 28: 1245-1257.
16. Bentayeb M, Simoni M, Norback D, Baldacci S, Maio S, et al. (2013) Indoor air pollution and respiratory health in the elderly. Journal of Environmental Science and Health, Part A 48: 1783-1789.
17. Yoon HI, Hong YC, Cho SH, Kim H, Kim YH, et al. (2010) Exposure to volatile organic compounds and loss of pulmonary function in the elderly. Eur Respir J 36: 1270-1276.
18. LifeAire Systems (2022) Protect Your Life. Protect Your Air. LifeAire Systems, Pennsylvania, USA.
19. Urrutia AR, Schlener SD, Eid S, Bock KA, Worrilow KC (2023) The Effects of an Advanced Air Purification Technology on Environmental and Clinical Outcomes in a Long-Term Care Facility. J Gerontol A Biol Sci Med Sci.

HERALD

Advances In Industrial Biotechnology | ISSN: 2639-5665

Advances In Microbiology Research | ISSN: 2689-694X

Archives Of Surgery And Surgical Education | ISSN: 2689-3126

Archives Of Urology

Archives Of Zoological Studies | ISSN: 2640-7779

Current Trends Medical And Biological Engineering

International Journal Of Case Reports And Therapeutic Studies | ISSN: 2689-310X

Journal Of Addiction & Addictive Disorders | ISSN: 2578-7276

Journal Of Agronomy & Agricultural Science | ISSN: 2689-8292

Journal Of AIDS Clinical Research & STDs | ISSN: 2572-7370

Journal Of Alcoholism Drug Abuse & Substance Dependence | ISSN: 2572-9594

Journal Of Allergy Disorders & Therapy | ISSN: 2470-749X

Journal Of Alternative Complementary & Integrative Medicine | ISSN: 2470-7562

Journal Of Alzheimers & Neurodegenerative Diseases | ISSN: 2572-9608

Journal Of Anesthesia & Clinical Care | ISSN: 2378-8879

Journal Of Angiology & Vascular Surgery | ISSN: 2572-7397

Journal Of Animal Research & Veterinary Science | ISSN: 2639-3751

Journal Of Aquaculture & Fisheries | ISSN: 2576-5523

Journal Of Atmospheric & Earth Sciences | ISSN: 2689-8780

Journal Of Biotech Research & Biochemistry

Journal Of Brain & Neuroscience Research

Journal Of Cancer Biology & Treatment | ISSN: 2470-7546

Journal Of Cardiology Study & Research | ISSN: 2640-768X

Journal Of Cell Biology & Cell Metabolism | ISSN: 2381-1943

Journal Of Clinical Dermatology & Therapy | ISSN: 2378-8771

Journal Of Clinical Immunology & Immunotherapy | ISSN: 2378-8844

Journal Of Clinical Studies & Medical Case Reports | ISSN: 2378-8801

Journal Of Community Medicine & Public Health Care | ISSN: 2381-1978

Journal Of Cytology & Tissue Biology | ISSN: 2378-9107

Journal Of Dairy Research & Technology | ISSN: 2688-9315

Journal Of Dentistry Oral Health & Cosmesis | ISSN: 2473-6783

Journal Of Diabetes & Metabolic Disorders | ISSN: 2381-201X

Journal Of Emergency Medicine Trauma & Surgical Care | ISSN: 2378-8798

Journal Of Environmental Science Current Research | ISSN: 2643-5020

Journal Of Food Science & Nutrition | ISSN: 2470-1076

Journal Of Forensic Legal & Investigative Sciences | ISSN: 2473-733X

Journal Of Gastroenterology & Hepatology Research | ISSN: 2574-2566

Journal Of Genetics & Genomic Sciences | ISSN: 2574-2485

Journal Of Gerontology & Geriatric Medicine | ISSN: 2381-8662

Journal Of Hematology Blood Transfusion & Disorders | ISSN: 2572-2999

Journal Of Hospice & Palliative Medical Care

Journal Of Human Endocrinology | ISSN: 2572-9640

Journal Of Infectious & Non Infectious Diseases | ISSN: 2381-8654

Journal Of Internal Medicine & Primary Healthcare | ISSN: 2574-2493

Journal Of Light & Laser Current Trends

Journal Of Medicine Study & Research | ISSN: 2639-5657

Journal Of Modern Chemical Sciences

Journal Of Nanotechnology Nanomedicine & Nanobiotechnology | ISSN: 2381-2044

Journal Of Neonatology & Clinical Pediatrics | ISSN: 2378-878X

Journal Of Nephrology & Renal Therapy | ISSN: 2473-7313

Journal Of Non Invasive Vascular Investigation | ISSN: 2572-7400

Journal Of Nuclear Medicine Radiology & Radiation Therapy | ISSN: 2572-7419

Journal Of Obesity & Weight Loss | ISSN: 2473-7372

Journal Of Ophthalmology & Clinical Research | ISSN: 2378-8887

Journal Of Orthopedic Research & Physiotherapy | ISSN: 2381-2052

Journal Of Otolaryngology Head & Neck Surgery | ISSN: 2573-010X

Journal Of Pathology Clinical & Medical Research

Journal Of Pharmacology Pharmaceutics & Pharmacovigilance | ISSN: 2639-5649

Journal Of Physical Medicine Rehabilitation & Disabilities | ISSN: 2381-8670

Journal Of Plant Science Current Research | ISSN: 2639-3743

Journal Of Practical & Professional Nursing | ISSN: 2639-5681

Journal Of Protein Research & Bioinformatics

Journal Of Psychiatry Depression & Anxiety | ISSN: 2573-0150

Journal Of Pulmonary Medicine & Respiratory Research | ISSN: 2573-0177

Journal Of Reproductive Medicine Gynaecology & Obstetrics | ISSN: 2574-2574

Journal Of Stem Cells Research Development & Therapy | ISSN: 2381-2060

Journal Of Surgery Current Trends & Innovations | ISSN: 2578-7284

Journal Of Toxicology Current Research | ISSN: 2639-3735

Journal Of Translational Science And Research

Journal Of Vaccines Research & Vaccination | ISSN: 2573-0193

Journal Of Virology & Antivirals

Sports Medicine And Injury Care Journal | ISSN: 2689-8829

Trends In Anatomy & Physiology | ISSN: 2640-7752