

OpenBlue Healthy Buildings

Measuring the return on Indoor Air Quality investment



What is IAQ and why does it matter?

Improving Indoor Air Quality (IAQ) is not only the right thing to do for employees, but it can also strengthen your facility's bottom line and increase your company's competitiveness when recruiting new employees.

A bottom-up approach considering well-documented costs leads to an expected return on investment in the range of \$750 to \$800 per employee per year in the US.

Factor	Productivity Loss per Employee per Year	Upside per Year
Influenza and common cold	\$19 to \$27	
Asthma and allergies	\$26 to \$66	
Legionnaires' disease	\$0.25	
Boost in productivity		Min. \$700
Total per employee	\$45 to \$93	Min. \$700
Total per ft²	\$0.36 to \$0.75	Min. \$5.6

Introduction

Indoor environments influence the health and productivity of workers. To put a financial estimate on the impact, it is practical to consider the many ways the indoor environment impacts a diverse workforce, including absenteeism, presenteeism (working while sick) and productivity.

Indoor air affects both absenteeism and presenteeism of employees in the following ways^a:

- COVID-19 has demonstrated that ventilation is a key contributor to the spread of respiratory infections. Beyond COVID-19, influenza and common cold infections are also major contributors to absenteeism.
- Indoor air has significant impact on people who suffer from conditions such as asthma, COPD and/or allergies.

- Legionnaires' disease impacts as many as 10,000 people every year and is lethal in 1 percent of the cases.
- Sick Building Syndrome, which is defined by the World Health Organization as "situations in which building occupants experience acute health and comfort effects that appear to be linked to the time spent in a building, but no specific illness or cause can be identified".

We will leave out the impact of tobacco from our discussion as most indoor environments are now tobacco free, but it may impact employees in specific settings, e.g., casinos.

Absenteeism and presenteeism

Communicable respiratory infections: Influenza and common cold

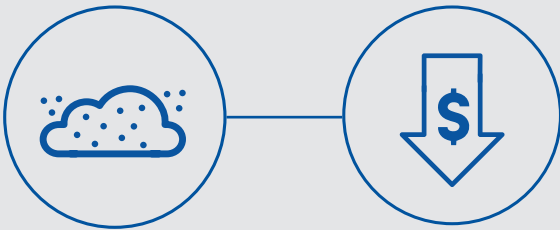
While COVID-19 is top of mind, trying to put an estimate on its cost is not realistic. Issues such as the phase of the pandemic (before or after vaccine availability) and the type of business (restaurant vs software engineering firm) make it widely variable.

On the other hand, we have ample history regarding the impact of influenza and the common cold. Currently in the US, the estimated cost of absence due to these two illnesses is estimated at \$16.4B^{bc}, not including the direct healthcare cost.

COVID-19 studies confirmed the various indoor environment factors that impact virus transmissions, including:

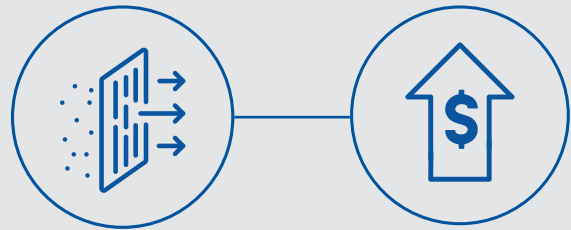
- Outdoor ventilation rate
- Rate and efficiency of filtration
- Disinfection
- Air recirculation rate
- Occupancy density
- Temperature and humidity

Reducing the impact of respiratory infection



- Respiratory infections reduce productivity by an \$19.4B each year^(b c)
- Improved IAQ could reduce respiratory infection cases by 10–14%^(d) and avoid \$1.9B–\$2.7B in lost productivity.

Improving life for allergy and asthma sufferers



- Asthma and allergies reduce productivity through absence and presenteeism by an \$29B each year^(g)
- Improved IAQ could reduce cases by 6–15%^(h) and avoid \$2.6B–\$6.6B in lost productivity.

Asthma and allergies

While asthma and allergies affect significantly fewer people than airborne respiratory infections, sufferers of these conditions do experience multiple episodes a year, leading to a higher level of absenteeism.

The same environmental factors that impact communicable respiratory infection impact asthma and allergies. Additionally,

outdoor pollen events trigger episodes, and these can be controlled by filtration.

The estimated cost of absence due to asthma^e is \$2.3B (1.8 days of absence per person) and \$13B due to allergic rhinitis^f.

Presenteeism due allergic rhinitis is estimated at \$29B^g.

Legionnaires' disease

Even given the relatively low magnitude of its economic impact, Legionnaire's disease is easily transmitted and can be fatal. This makes investment in well-managed IAQ critical to occupant safety.

Nearly 1% of Legionnaires' disease cases are fatal

Non-specific building-related symptoms including Sick Building Syndrome

Current estimates vary too widely to establish a number that is useful for the purpose of this review. It is likely very large as one out of four buildings in the US are impacted, with a conservative estimate of close to \$4B¹ in impact.



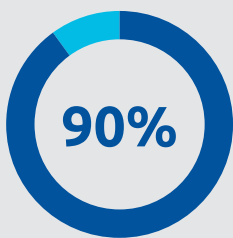
Employee productivity

Several studies have documented improvement in employee cognitive function in buildings with above-average indoor air quality.

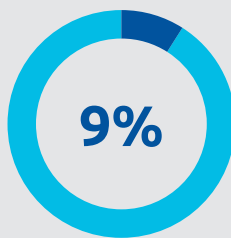
A study looking at the impact of CO₂ and TVOC on the cognitive function of office workers^k shows as much as 61 percent

improvement of cognitive functions in a green building (CO₂ level of ~750ppm, and TVOC level of 45 µg/m³) vs a conventional building (CO₂ level of ~950ppm, and TVOC level of 550 µg/m³), with the largest benefits seen in tasks such as crisis response, information usage and strategy.

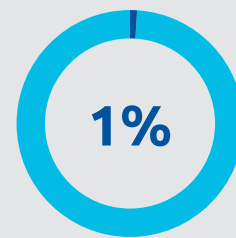
Considering the model developed by the World Green Building Council^l stating that typical business operating cost can be allocated in the following way:



staff costs in salaries and benefits



in rental costs



in energy costs

A conservative one percent improvement in productivity can generate as much as a three and a half percent improvement in EBIT^m, over three times the entire energy budget of the building. Considering an average employee cost of \$70,000 per year, this can be over \$700 per person.



Summary

We have identified several reasons why IAQ can impact operating cost. This bottom-up approach acknowledges each individual cost without double counting. We have purposely excluded healthcare costs, but those costs should be considered in certain countries.

The current data clearly shows that better managed Indoor Air Quality can conservatively return \$750 to \$800 per employee per year.

While these numbers are derived from situations in the US market, the methodology can be extrapolated in other parts of the world by adjusting the average office salary.



Next steps

Your local Johnson Controls experts can create a solution and service package to make your facility healthier and more efficient. Contact them to today to find our more.

Note: All \$ figures provided in this document have been normalized to 2022 using CPI index, and to a US indoor work population of 100 million. For purpose of conversion from employee to square foot, we use the number of 125 ft² per employee.

About OpenBlue

OpenBlue is a complete suite of connected solutions that serves industries from workplaces to schools, hospitals to campuses, and beyond. This platform includes tailored, AI-infused service solutions such as remote diagnostics, predictive maintenance, compliance monitoring, advanced risk assessments, and more. A dynamic new space from Johnson Controls, OpenBlue is how buildings come alive.

^{adj} Improving the Health of Workers in Indoor Environments: Priority Research Needs for a National Occupational Research Agenda. Mark J. Mendell, PhD, MPH, William J. Fisk, MS, Kathleen Kreiss, MD, Hal Levin, BArch, Darryl Alexander, MPH, William S. Cain, PhD, John R. Girman, MS, Cynthia J. Hines, MS, Paul A. Jensen, PhD, Donald K. Milton, MD, DrPH, Larry P. Rexroat, MST, and Kenneth M. Wallingford, MS

^b Economic burden of seasonal influenza in the United States. Wayan C.W.S. Putri, David J. Muscatello, Melissa S. Stockwell, Anthony T. Newall

^c The Economic burden of non-influenza-related viral Respiratory Tract Infection in the United States. A. Mark Fendrick, MD, Arnold S. Monto, MD, Brian Nightengale, PhD, Matthew Sarnes, PharmaD

^e The Economic Burden of Asthma in the United States 2008-2013. Tursynbek Nurmagambetov, Robin Kuwahara, and Paul Garbe

^{fg} Economic impact of workplace productivity losses due to allergic rhinitis compared with select medical conditions in the United States from an employer perspective. Charles E. Lamb, Paul H. Ratner, Clarion E. Johnson, Ambarish J. Ambegaonkar, Ashish V. Joshi, David Day, Najah Sampson & Benjamin Eng

ⁱ Economic Burden of Legionnaires' Disease, United States, 2014. Madeleine Baker-Goering, Kakoli Roy, Chris Edens, Sarah Collier

^k Associations of Cognitive Function Scores with Carbon Dioxide, Ventilation, and Volatile Organic Compound Exposures in Office Workers: A Controlled Exposure Study of Green and Conventional Office Environments. Joseph G. Allen, Piers MacNaughton, Usha Satish, Suresh Santanam, Jose Vallarino, and John D. Spengler

^l Health, Wellbeing & Productivity in Offices. The next chapter for green building. World Green Building Council

^m Healthy Buildings. How indoor spaces drive performance and productivity. Joseph G. Allen, John D. Macomber



SS2206001