



IMPROVING K-12 SCHOOLS WITH OMNIBUS FUNDING AND SCIENCE-BASED RESEARCH

Healthier schools start here. And thanks to new federal funding, they can start now.

The United States government has set aside nearly \$200 billion for COVID-related stimulus efforts, including HVAC system updates and safety and security solutions in K-12 schools.

As the leading global provider of innovative healthy, safe and sustainable building solutions, Carrier is expanding its [Healthy Buildings Program](#) offerings to help K-12 students, teachers and staff safely return to in-person instruction. Your [local Carrier expert](#) can provide guidance on accessing Elementary and Secondary School Emergency Relief (ESSER) funding from the application process and language to timing.

KEY PRIORITIES



THE PROBLEM: COSTS OF SCHOOL CLOSURES

School closures due to the COVID-19 pandemic have had an enormous impact, affecting nearly 85% of primary and secondary learners globally and leading to many long-term impacts including academic and social regression, food insecurity, increased risk of neglect and violence, and the exacerbation of many of society's existing inequities.¹ Research has also found that school-aged children are typically less likely to become infected with COVID-19, less likely to suffer severe consequences, and less likely to transmit the virus to others.² However, despite the profound consequences of school closures and the knowledge of how to reduce risk for both kids and adults in schools, millions of students in the U.S. did not have full-time school during the pandemic.



THE EVIDENCE: AIRBORNE TRANSMISSION OF COVID-19

Key studies have continuously pointed to airborne transmission of COVID-19, underscoring the importance of school building-level risk reduction strategies such as ventilation and filtration. Basic aerosol physics show that people shed an entire continuum of particles when they cough, sneeze or talk, including smaller particles that can stay afloat for hours and travel beyond six feet.³ Air sampling research has detected viable SARS-CoV-2 virus in these airborne particles, well beyond six feet from infected patients.⁴ Leading modeling studies have also identified airborne transmission as the leading contributor to infections in case studies of superspreading events.⁵



THE OPPORTUNITY: HEALTHY SCHOOLS

When managed poorly, school buildings can exacerbate the transmission of airborne infectious diseases. School infrastructure is chronically underfunded, and low ventilation and poor indoor air quality have been identified as consistent trends in school buildings for decades. Most schools do not meet even the bare minimum American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) ventilation design standard for acceptable ventilation and indoor air quality.⁶ Under-ventilated buildings have been implicated in many large COVID-19 outbreaks, but efforts to reopen schools have not consistently prioritized health-based indoor air quality improvements.⁷





THE SOLUTION: A HOLISTIC RISK REDUCTION STRATEGY

To help schools reopen (and stay open), a holistic, evidence-based, layered defense approach that simultaneously utilizes multiple strategies is recommended. Harvard's Healthy Buildings Program, led by Dr. Joseph Allen, authored the Schools for Health report answering critical questions related to school reopening.⁸ The report describes a holistic risk reduction strategy that combines school building controls with other critical risk reduction strategies, such as masking and distancing, to create healthy classrooms, buildings, policies, schedules, and activities in schools.



HEALTHY CLASSROOMS



HEALTHY BUILDINGS



HEALTHY POLICIES



HEALTHY SCHEDULES



HEALTHY ACTIVITIES

Figure 1. Risk reduction strategies for reopening schools. Reprinted from Schools For Health: Risk Reduction Strategies for Reopening Schools, by Harvard Healthy Buildings Program, 2020, retrieved from ForHealth.org. Copyright 2020 Harvard T. H. Chan School of Public Health.

EVIDENCE-BASED SCHOOL BUILDING IMPROVEMENTS

VENTILATION AND FILTRATION

Once-in-a-generation funds for Elementary and Secondary School Emergency Relief should be applied toward health-based building improvements that are proven to reduce risk of infectious disease transmission, as well as provide long-term benefits for student and teacher health and academic performance. Schools should prioritize control strategies, starting with bringing in more fresh air and targeting ventilation rates between four and six air changes per hour.^{8,9} If air must be recirculated, then increase the filter efficiency to MERV 13 or higher.

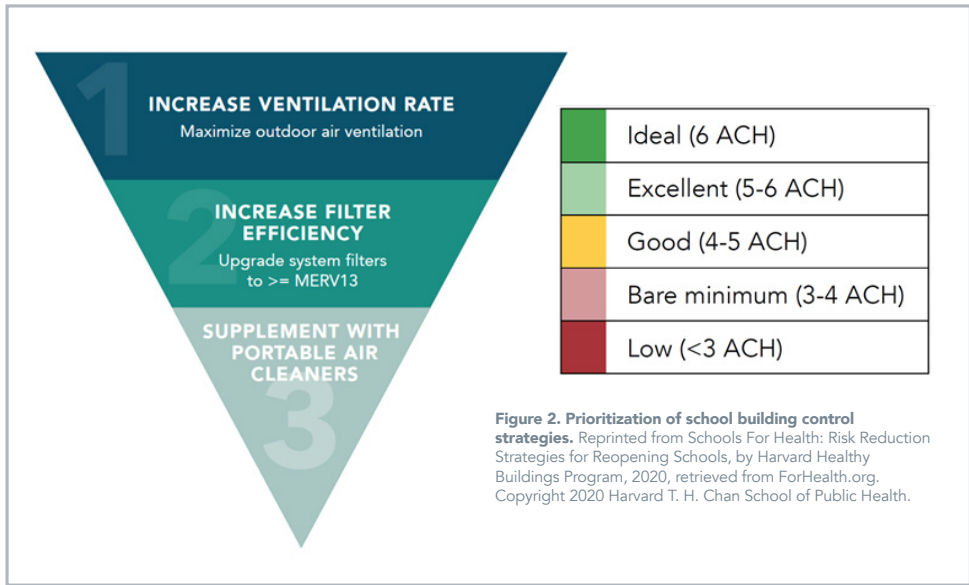


Figure 2. Prioritization of school building control strategies. Reprinted from Schools For Health: Risk Reduction Strategies for Reopening Schools, by Harvard Healthy Buildings Program, 2020, retrieved from ForHealth.org. Copyright 2020 Harvard T. H. Chan School of Public Health.

SIMPLE, LOW-COST OPTIONS

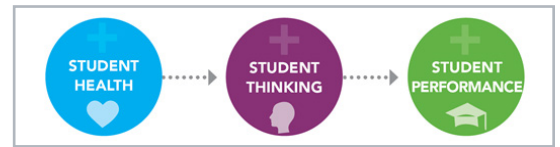
In the face of limited resources and aging school building infrastructure, schools can take simple, low-cost steps to reduce exposure in classrooms, such as utilizing properly-sized portable air cleaning units with high efficiency particulate air (HEPA) filtration and opening the windows. One modeling study found that in a typical physically-distanced indoor classroom with low ventilation and closed windows, about three percent of the air each person breathes was exhaled by other people, even when masks are worn universally.¹⁰ When an infected person was introduced into the classroom, peak levels of air contamination were reached within a short amount of time. Fresh air from a single open window diluted the contaminants in the space, and when a box fan and a portable air cleaner with HEPA filtration was added to the simulated classroom, target air exchange rates were achieved, and the overall concentration of contaminants were at their lowest.

BUILDING ASSESSMENTS

Building assessments are a critical step in the safe reopening of schools. Schools should set health-based targets for indoor air quality, and assess the ability of the existing building systems to achieve those targets. Commissioning is the process of checking heating, ventilation and air conditioning performance to ensure that systems are operating as designed, and in alignment with health-based air quality targets. Schools should engage with trained professionals to verify building performance after long periods of vacancy, and building system performance should continue to be verified regularly after reoccupancy. If the existing systems and approach are not sufficient to meet health-based targets, HVAC, filtration, air cleaning, and building monitoring system upgrades may be considered.

BENEFITS BEYOND COVID-19

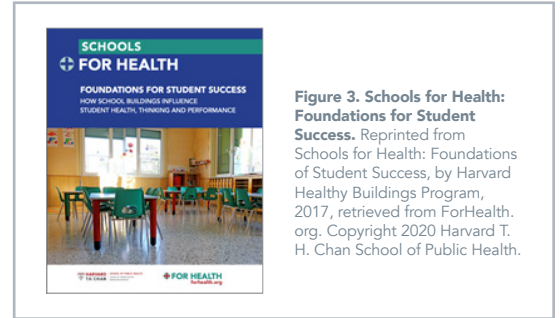
Student-teacher ratios, test scores, curriculum, and arts and sports programs are commonly discussed by many families when assessing the quality of a school. However, the school building itself, beyond looks and amenities, is rarely considered.



THE EVIDENCE: MULTIPLE BENEFITS OF HEALTHY SCHOOLS

The benefits of school building improvements for indoor air quality and ventilation go well beyond COVID-19 and disease avoidance; decades of scientific research supports the direct impacts that buildings have on student health, student thinking, and student performance.¹¹ Evidence shows that ventilation and air cleaning improvements lead to improved academic performance, fewer respiratory symptoms, fewer missed school days, and higher test scores – as well as many benefits for teachers including reduced absenteeism, increased teacher retention, and improved morale.

- **Upper respiratory symptoms and missed school days** are associated with poor ventilation, dampness (commonly ventilation related) and moisture.¹²
- Cognitive testing of students shows a **5% decrease in "power of attention"** in poorly ventilated classrooms.¹³
- **Mean mathematics scores increased by up to 0.5%** per each liter per second per person increase in ventilation rate.¹⁴
- Students in classrooms that received portable mechanical ventilation systems interventions **performed faster and more accurately on computerized tasks**.¹⁵



UNEVEN DISTRIBUTION OF RISKS

The impacts of unhealthy school buildings are not evenly distributed; schools in developing countries and students of lower socio-economic status have been shown to be disproportionately impacted by poor indoor air quality due to schools in closer proximity to busy roads and other environmental pollution sources. These schools are also more likely to be overcrowded, aging buildings with fewer resources for proper building maintenance. One study evaluated the effects of school building factors and academic achievement, and found that on average, African American, Hispanic, and free lunch eligible students were exposed to lower ventilation rates and higher classroom temperatures – both of these factors were also associated with lower test scores and academic performance.¹⁴

HEALTHY BUILDINGS ASSESSMENTS FOR SCHOOLS

At Carrier, we understand that many schools and districts are facing uncertainty with how to move forward in developing a healthy building strategy. Retrofits, modernizations and upgrades must be done with student health and safety as a top priority, while being smart about costs, budgets and future requirements. Our experts are here to help – starting with assessments across various aspects of a building.

INDOOR AIR QUALITY
THERMAL COMFORT
OCCUPANCY FLOW
BUILDING MAINTENANCE
REGULAR HOUSEKEEPING
ENERGY EFFICIENCY
SAFETY AND SECURITY



SIMPLY AND EASILY INCREASE FILTRATION IN ANY ROOM

Improve Filtration with Carrier OptiClean™

The HEPA filter equipped air scrubber that's ready to roll into every classroom.

The [Carrier OptiClean air scrubber](#) is the fastest, most visible way to show your commitment to your students, teachers and staff.

- Rapid deployment
- High-efficiency HEPA filtration
- Portable, flexible and easy to reconfigure
- Supplements your existing system
- Easy to specify
- Exceeds ASHRAE's school reopening recommendation*
- Choose from three sizes

*When properly specified.

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CONSIDER SECURITY AS PART OF HEALTH AND SAFETY

AREAS OF OPPORTUNITY

- Customize access
- Reduce physical touchpoints
- Add protection via remote door locks
- Enhance mass notification capabilities

MODERNIZE EVACUATION PROCEDURES AND SYSTEMS

AREAS OF OPPORTUNITY

- Rethink evacuation plans
- Deploy voice-based notification systems
- Install multi-criteria alarms
- Implement connected emergency communications systems

CARRIER HEALTHY BUILDINGS PROGRAM

As the inventors of modern air conditioning and a world leader in HVAC, refrigeration, and fire and security solutions, Carrier has a legacy of creating safe and comfortable buildings. Our experts have in-depth knowledge and experience in K-12 school buildings and a holistic suite of healthy building technologies and services to address the immediate pandemic concerns and long into the future.

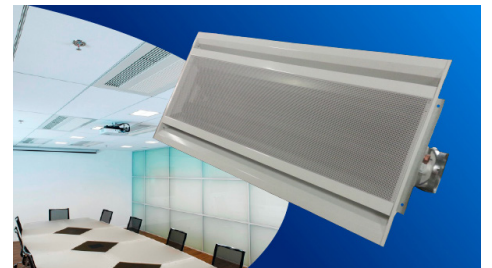
AIRSIDE TECHNOLOGIES

HEALTHY BUILDINGS SOLUTIONS FOR SCHOOLS

Carrier offers a full suite of products and services designed to help create safe and healthy environments for students and educators. The following are just a few highlights of our offering.



[OPTICLEAN AIR SCRUBBER](#)



[ACTIVAIR™ INDUCTION BEAMS](#)

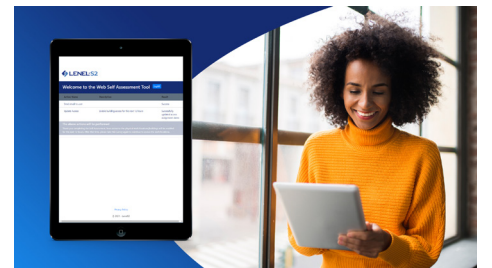
SECURITY



[ACCESS CONTROL AND OCCUPANCY MANAGEMENT](#)



[REDUCE TOUCH POINTS](#)



[ASSESSMENT SOLUTIONS](#)

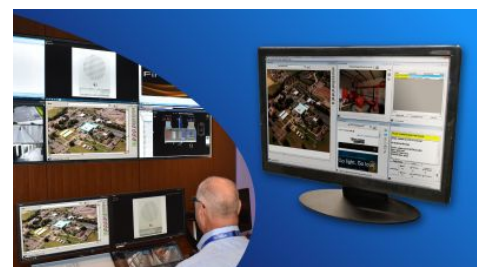
FIRE AND LIFE SAFETY



[OPTICA™ MULTI-CRITERIA DETECTOR](#)



[EST4 ADVANCED LIFE SAFETY AND EMERGENCY COMMUNICATIONS PLATFORM](#)



[FIREWORKS® INCIDENT MANAGEMENT PLATFORM](#)



GOVERNMENT FUNDING AND BUYING GROUPS

New purchases of HVAC equipment and service may qualify for tax benefits and may also be eligible for state-specific contracts.

Connect with [your local Carrier expert](#) for more information about funding assistance and your HVAC system needs.

HOW TO BUY IN 3 EASY STEPS

- 1 Contact your local Carrier rep for equipment, service or parts needs.
- 2 Communicate your intention to use federal or state funding or buying group assistance.
- 3 Your local representative will work with Carrier to fulfill your requirements in accordance with the terms of the initiative.



CARRIER BLUEDGE SERVICE PROGRAM

Our BluEdge K-12 service program provides an outcome-based approach to help you select the best indoor air quality (IAQ) kits for your school's needs, with attractive pricing and easier implementation.

As the U.S. government prepares to roll out the \$2 trillion American Rescue Plan Act for coronavirus relief, Carrier is expanding its Healthy Buildings Program offerings to help K-12 students, teachers and staff safely return to in-person instruction. These new K-12 indoor air quality solutions provide simple, flexible, cost-effective kits for schools to protect occupant health while enabling in-person instruction. For more information, read about the Carrier [BluEdge K-12 program](#) and contact [your local Carrier expert today](#).



GET STARTED WITH AN EXPERT

From a safe reopening in the coming months to ongoing enhancements to student performance, a healthier future starts indoors. Let's work together to unlock the enormous potential of healthy schools. Visit us at carrier.com/k-12/may for our "Resource Center" and "K-12 IAQ Library" that provide a wide array of information, and then connect with one of our experts.

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HEALTHY SCHOOLS