Airflow and elevators

OTIS

Highlights of an airflow study conducted to determine the relative risk of exposure[‡] to COVID-19 among elevator passengers

Elevators play an essential role in keeping people on the move, every day. Given what scientists now know about how COVID-19 is spread, people naturally have questions about the relative risks of congregating in common spaces, including elevators. As an industry leader, Otis is committed to finding answers that are based on rigorous scientific methods and the expertise of leading researchers in the field. **The study findings support the idea that elevator travel represents a lower exposure risk when coupled with mitigation, including the proper use of masks.**

THE STUDY

To support our customers with science-based information and solutions, Otis commissioned a three-month study focused on understanding the relative risk of COVID-19 in elevators. This research was led by Dr. Qingyan (Yan) Chen, the James G. Dwyer Professor of Mechanical Engineering at Purdue University, who worked closely with the Otis team.

The study methods used state-of-the-art computational fluid dynamics (CFD) modeling to simulate airflow to replicate particle dispersion during several two-minute elevator rides. For the elevator ride, we modeled multiple scenarios, including particle dispersion when the doors open as passengers get on and off the elevator.

For more technical details on the study methods, please visit otis.com.

THE METHODS AND FOCUS

With science continuing to point to respiratory droplets and aerosols as a principal means of transmission, the study focuses on airflow exclusively and the impact of ventilation rates and types, purification technologies (specifically needlepoint bipolar ionization) and mitigation strategies in elevators, including the proper use of masks.

- **Ventilation rate**
- **Ventilation type**, specific to the direction the fan blows
- **Cab configuration**, studying the most popular cab sizes with some variations
- Impact of **purification technologies**, specifically needlepoint bipolar ionization (NPBI)
- Impact of **proper mask usage**

BACKGROUND

The average elevator ride is short – less than two minutes – limiting the time a passenger is exposed to the virus. In addition, elevator codes require openings for ventilation. By design, elevators have a high level of air exchange. Higher airflow reduces the number of airborne particles by removing them from the elevator.

Exposure time is minimal due to a short average elevator ride (<2 min)[†]

By code, elevators are required to have openings for ventilation

[†] The typical elevator ride is <1 minute, further reducing time of exposure. The study considered the highest exposure in a 2-minute ride.

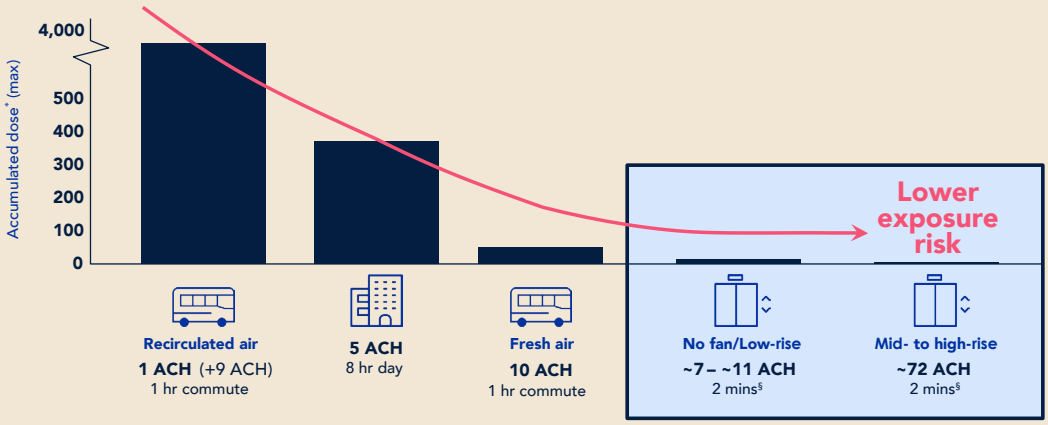
STUDY RESULTS

Coupled with what we already know about elevator design and operation, the study findings support the idea that elevator travel with mitigation represents a relatively low risk of exposure.

The high level of air exchange in an elevator lowers the exposure risk

The higher the elevator ventilation rate, the lower the accumulated dose* a passenger is potentially exposed to.

Relative risk of exposure and airflow impact for typical common spaces‡



ACH: Air changes per hour measures the air volume added or removed from a space in 1 hour, divided by the volume of the space. Higher values correspond to better ventilation.

§ Study simulated scenarios of 2 minutes to assess maximum risk. Average cab ride is generally <1 minute.

* Accumulated dose is the amount of virus a person is exposed to and depends on intensity, frequency and duration of exposure. Quantifies the relative risk of exposure.

Environmental factors (e.g., coughing, talking, rate of breathing, physical activity, cab configuration, etc.) may impact the overall exposure for an individual in any example of common spaces.

Mitigation strategies can reduce relative exposure even further

20-30% Reduced relative exposure

Air purification**, depending on ride time and riders' positions in elevator

×

50% Reduced relative exposure

Proper mask usage by all riders¶

=

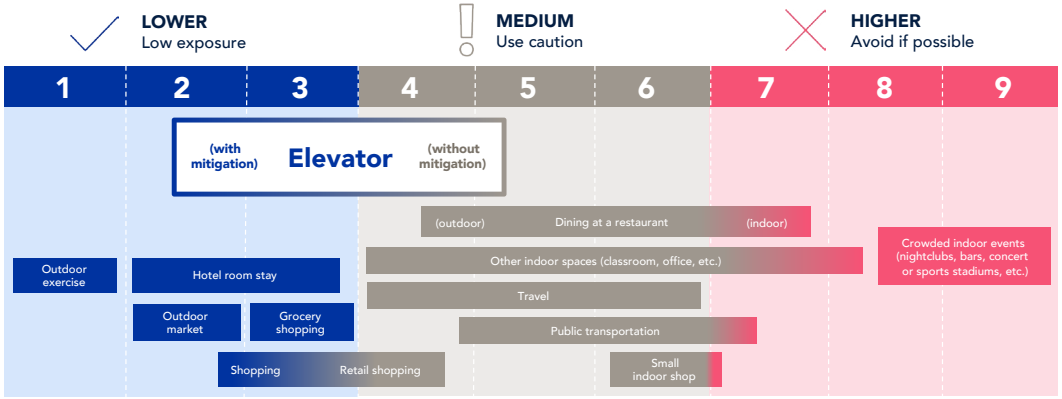
60-65% Reduced relative exposure

Proper mask usage by all riders combined with air purification**

** Needlepoint bipolar ionization (NPBI) as compared with no air purification device

¶ Proper mask usage compared with no masks. Assumes proper mask wearing of typical cloth or surgical style mask per WHO and CDC guidelines

Qualitative comparisons place riding in an elevator with mitigation in a lower-exposure category



Variation of intensity, frequency and duration of exposure contributes to different degrees of exposure even within each activity category

Adapted from relative framework originally proposed by Julie Marcus at Harvard and Eleanor Murray at Boston University

Risk of exposure in elevators can be lowered by applying proper mask usage, air purification (like NPBI), physical distancing, etc.

Made to move you™

This study and its findings are just a part of our commitment to providing science-based information throughout the COVID-19 pandemic and into the future.

Visit otis.com to view the white paper detailing the findings and other resources related to the study, along with solutions and strategies for limiting passenger exposure to the virus. The full study will be submitted for future publication in academic journals.

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