Ventilation Improvement Strategies Among U.S. K–12 Public Schools

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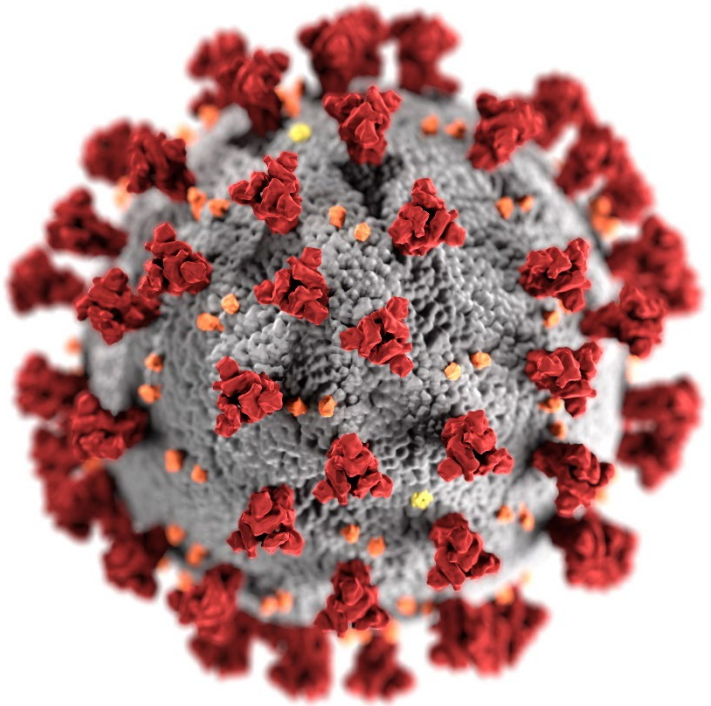


National Academies of Sciences, Engineering, and Medicine

Indoor Air Management of Airborne Pathogens: Workshop Series

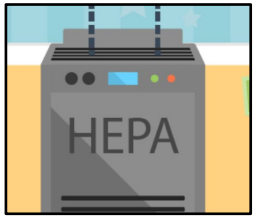
September 14, 2022

cdc.gov/coronavirus

Guidance for K-12 schools

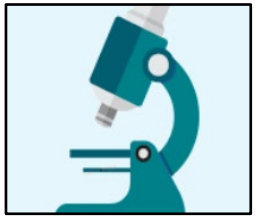
Masks

Ventilation

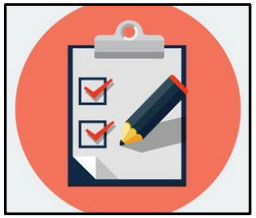


Vaccines

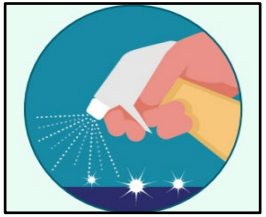
Testing



Staying home when sick



Cleaning & disinfection



Hand hygiene & respiratory etiquette

Contact tracing & case investigation

Note: Recommendations for some strategies vary by COVID-19 Community Level.

Source: Operational Guidance for K-12 Schools and Early Care and Education Programs to Support Safe In-Person Learning

Ventilation in schools

- Improved ventilation can reduce the concentration of infectious aerosols and duration of potential exposures.[1,2]

- Improved ventilation has been linked to better measures of respiratory health and better student outcomes.

Federal funding for ventilation improvements in schools

- U.S. Department of Education's Elementary and Secondary School Emergency Relief Fund
- Governor's Emergency Education Relief Fund
- U.S. Department of Health and Humans Services' FY 2021 American Rescue Plan Funding Increase for Head Start Programs funds
- Epidemiology and Laboratory Capacity for Prevention and Control of Emerging Infectious Diseases Reopening Schools supplement

1.Lindsley WG, Derk RC, Coyle JP, et al. Efficacy of portable air cleaners and masking for reducing indoor exposure to simulated exhaled SARS-CoV-2 aerosols—United States, 2021. MMWR Morb Mortal Wkly Rep 2021;70:972–6. Curtius J, Granzin M, Schrod J.
2.Testing mobile air purifiers in a school classroom: reducing the airborne transmission risk for SARS-CoV-2. Aerosol Sci Technol 2021;55:586–99.
3.Fisk WJ. The ventilation problem in schools: literature review. Indoor Air 2017;27:1039–51.

Strategies for improving ventilation in buildings (1 of 2)

- Increase the introduction of outdoor air
- Use fans to increase the effectiveness of open windows
- Rebalance or adjust HVAC systems to increase total airflow to occupied spaces when possible
- Use portable high-efficiency particulate air (HEPA) fan/filtration systems
- Use ultraviolet germicidal irradiation (UVGI)

Source: https://www.cdc.gov/coronavirus/2019-ncov/community/ventilation.html

Strategies for improving ventilation in buildings (2 of 2)

Strategies differ in terms of required:

- Financial costs
- Supplies
- Physical structure
- Expertise
- User effort

The National School COVID-19 Prevention Study (NSCPS)

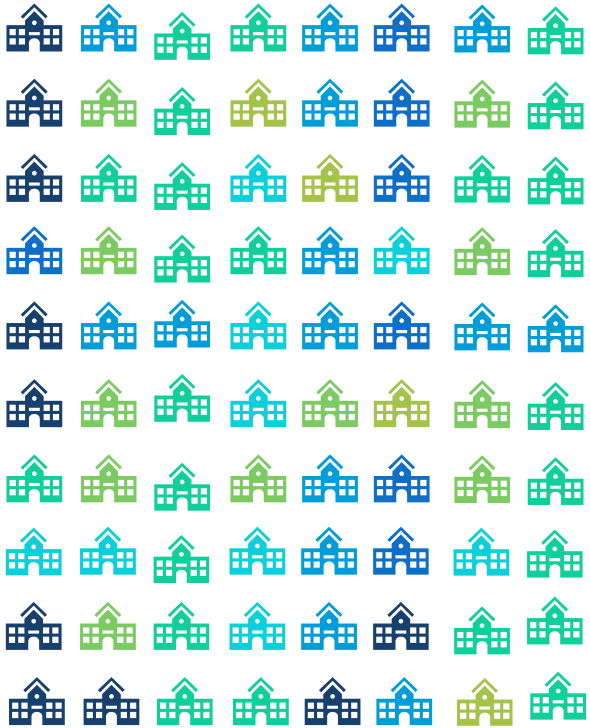
- Launched in 2021 by CDC to better understand COVID-19 prevention strategies in schools.
- A component of the NSCPS is a series of surveys administered to school-level designees (e.g., principals) in a nationally representative sample of public K-12 schools.

Stratified Random Sample

Survey respondents: principals or other school level official

Population

K-12 public schools in the US



School-level

- Elementary
- Middle
- High

Urban status

- City
- Suburb
- Town
- Rural

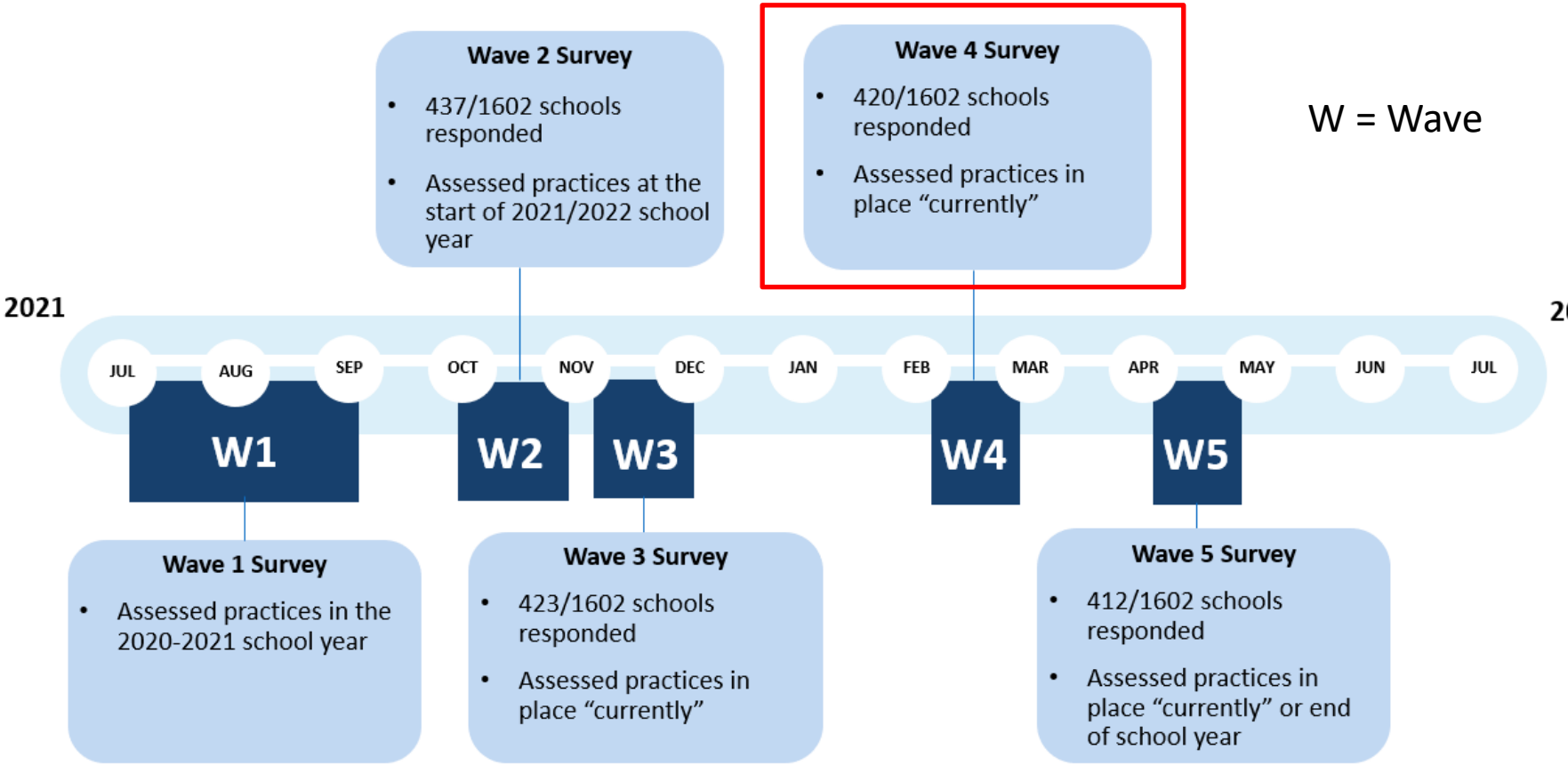
Census region

- Northeast
- Midwest
- South
- West

Sample

1602 K-12 public schools in the US

NSCPS timeline



Measures and statistical analyses

Ventilation strategies

- 11 ventilation improvement strategies in schools and on school-based transportation

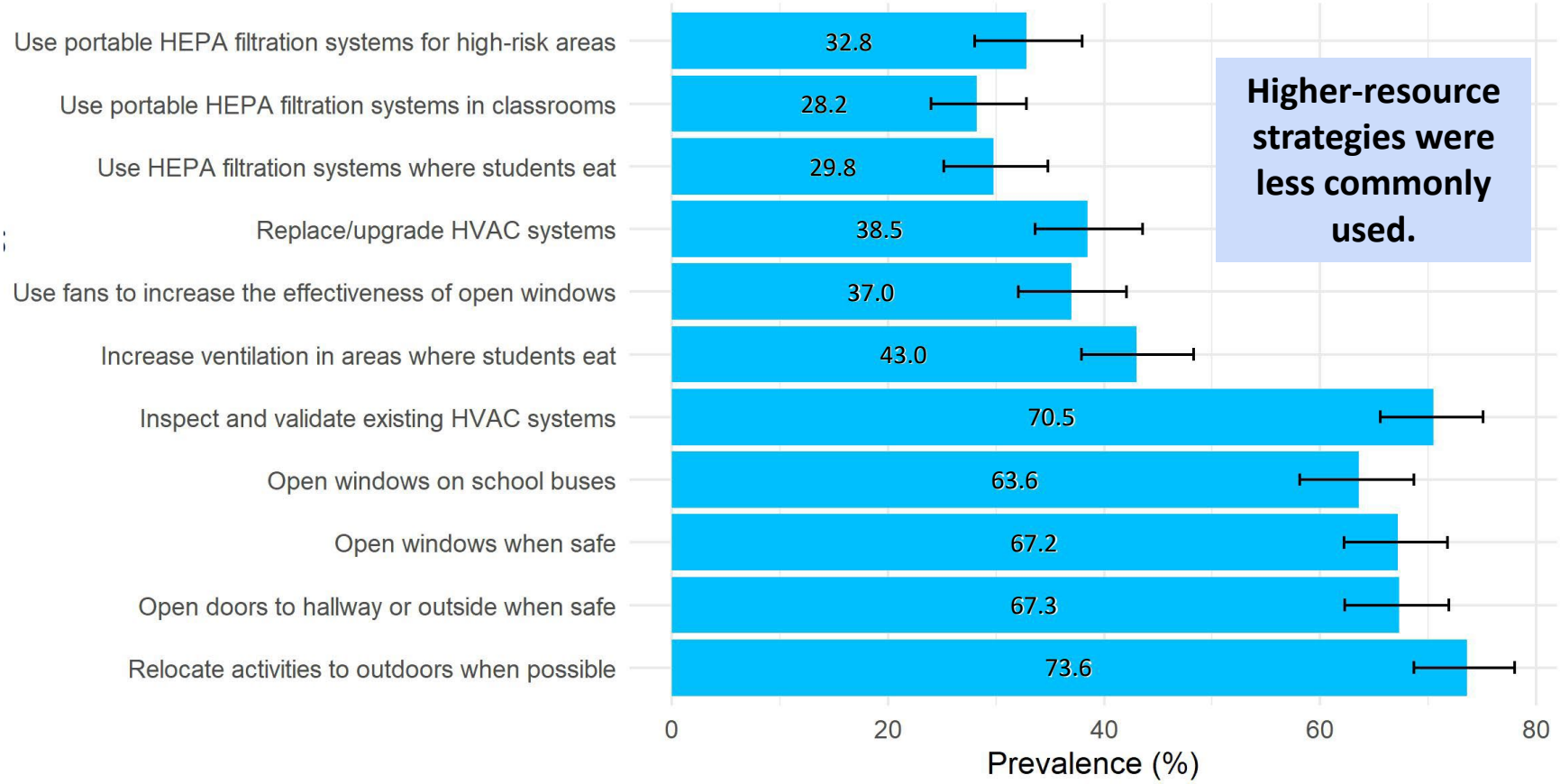
School characteristics

- National Center for Education Statistics school locale: rural, town, suburb, city
- School poverty: Low-, mid-, and high-poverty schools were defined as schools with ≤25%, 26%–75%, and ≥76% of students eligible for free- or reduced- price meals, respectively

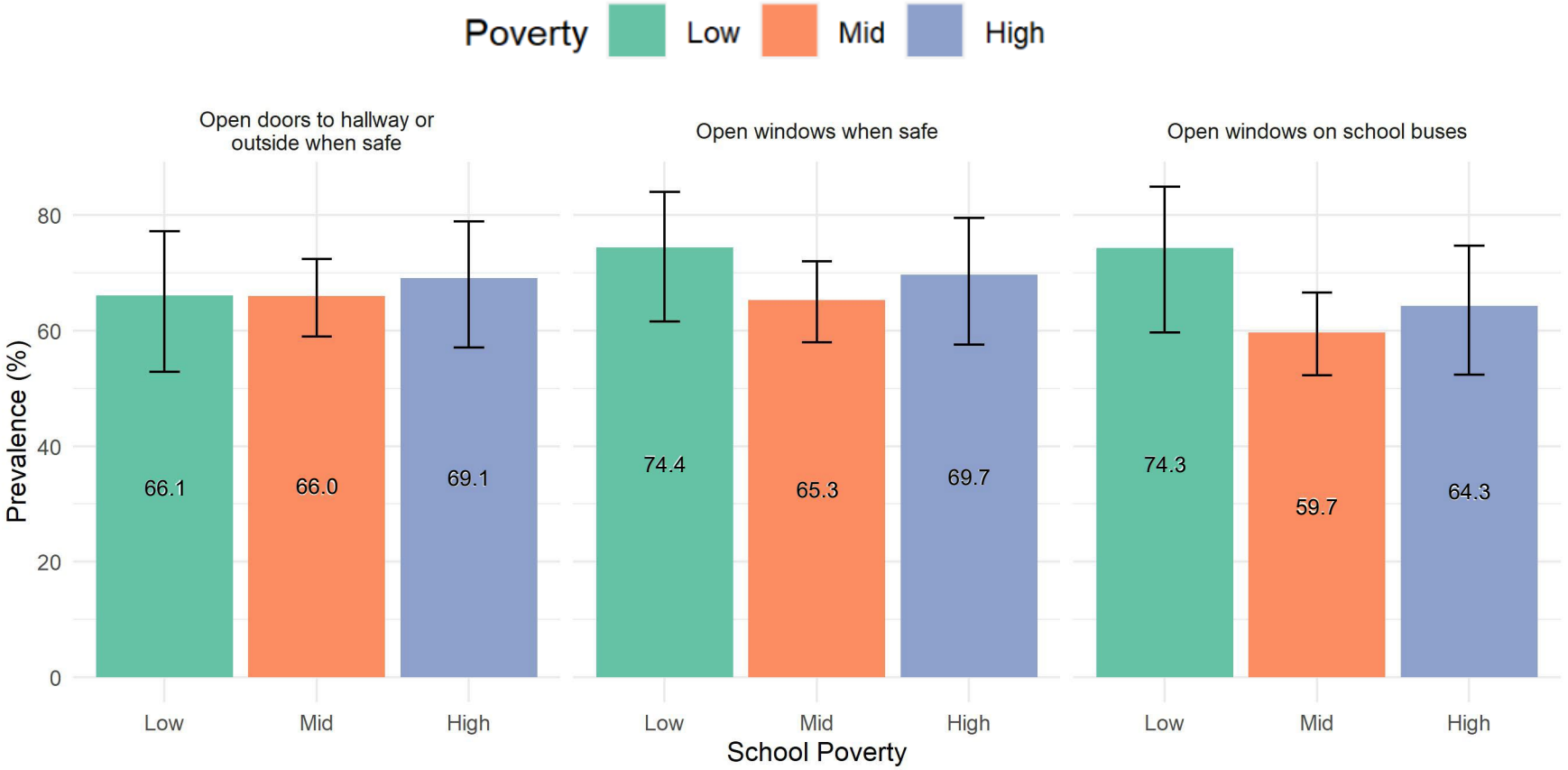
Statistical analyses

- Weighted prevalence of ventilation strategies, including by school characteristics
- Differences in ventilation strategies by school characteristics examined using chi-square tests

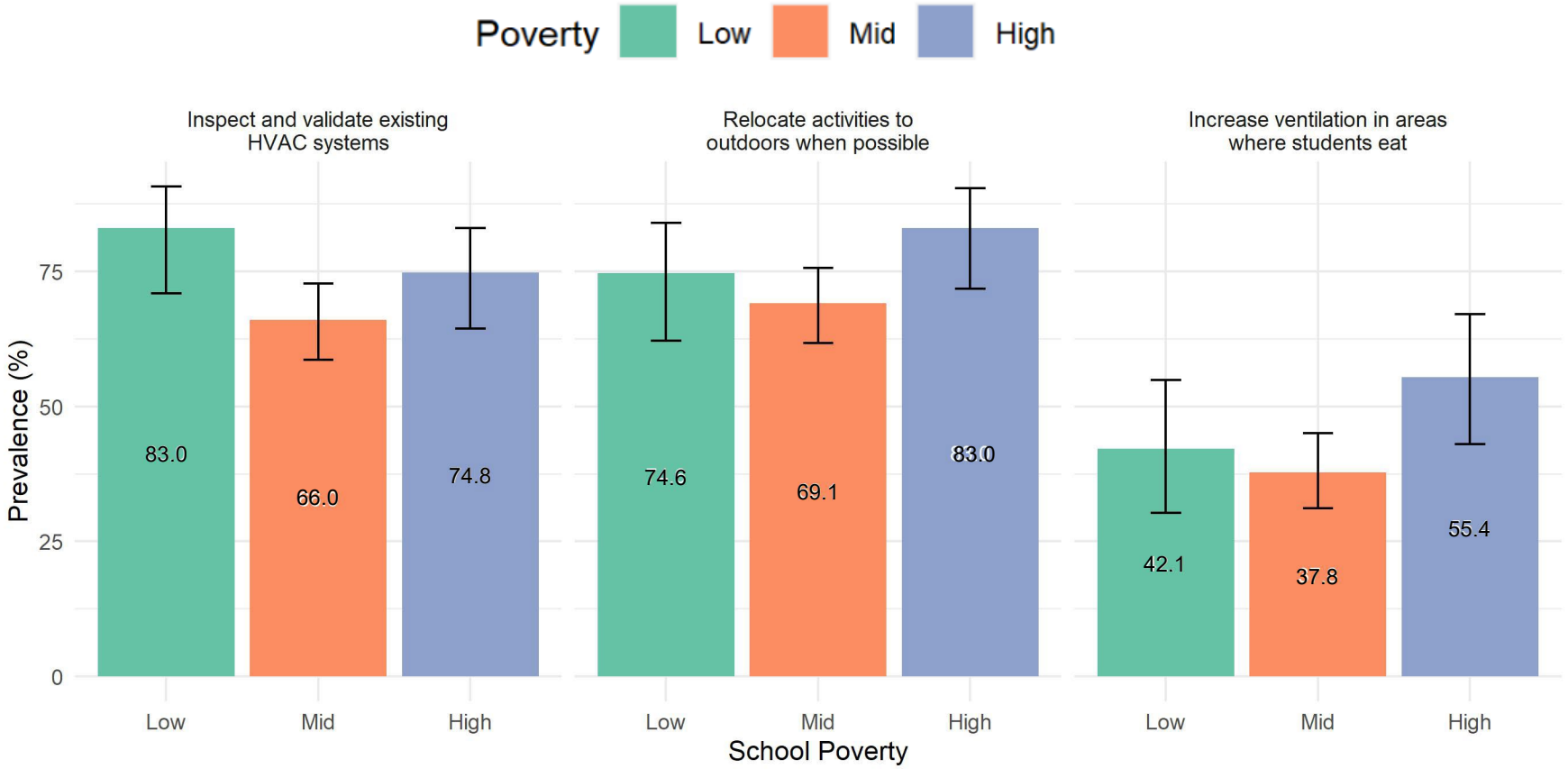
Prevalence of ventilation strategies



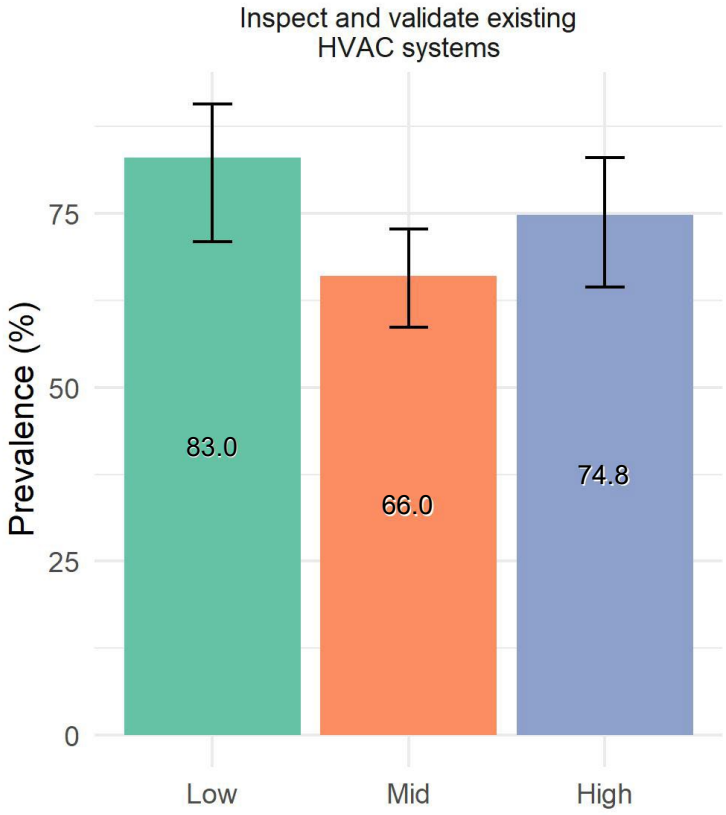
Strategies relating to opening doors/windows did not vary by school poverty.



Differences in ventilation strategies by school poverty (1 of 2)

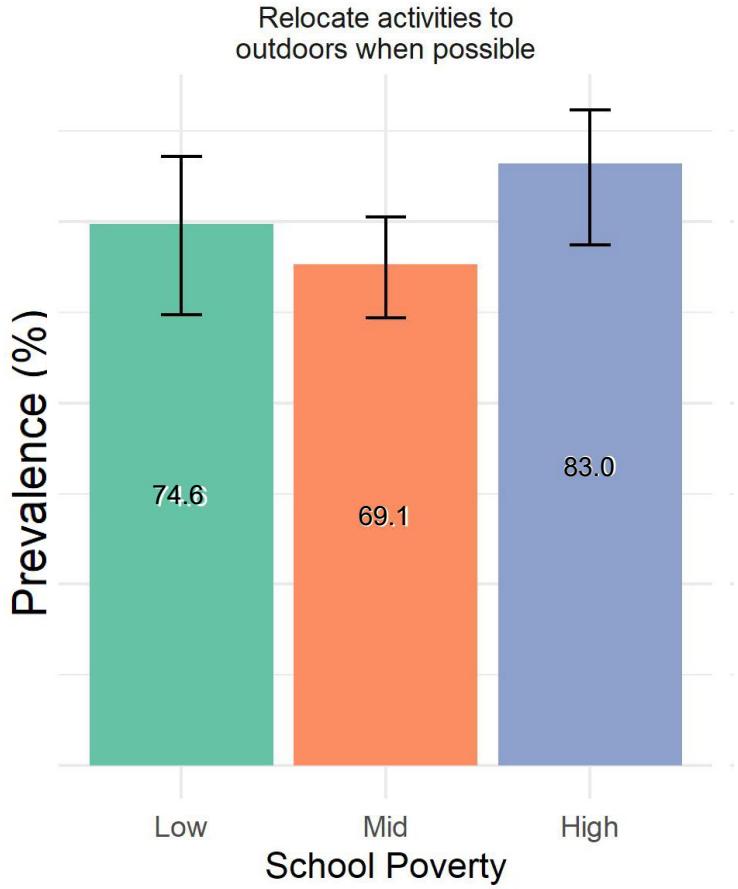


Inspecting and validating HVAC systems by school poverty



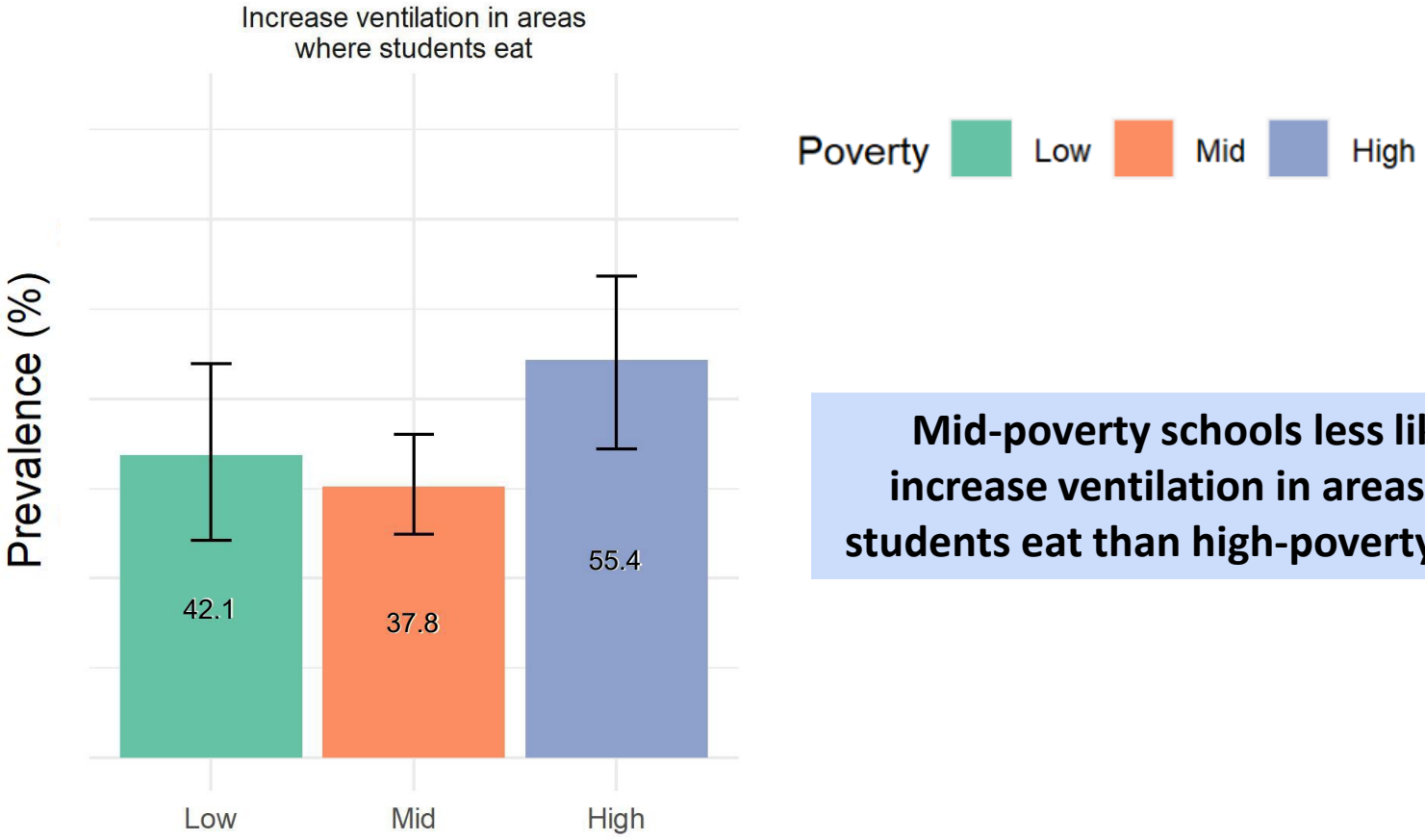
Mid-poverty schools less likely than low-poverty schools to inspect and validate existing HVAC systems.

Relocating outdoors by school poverty



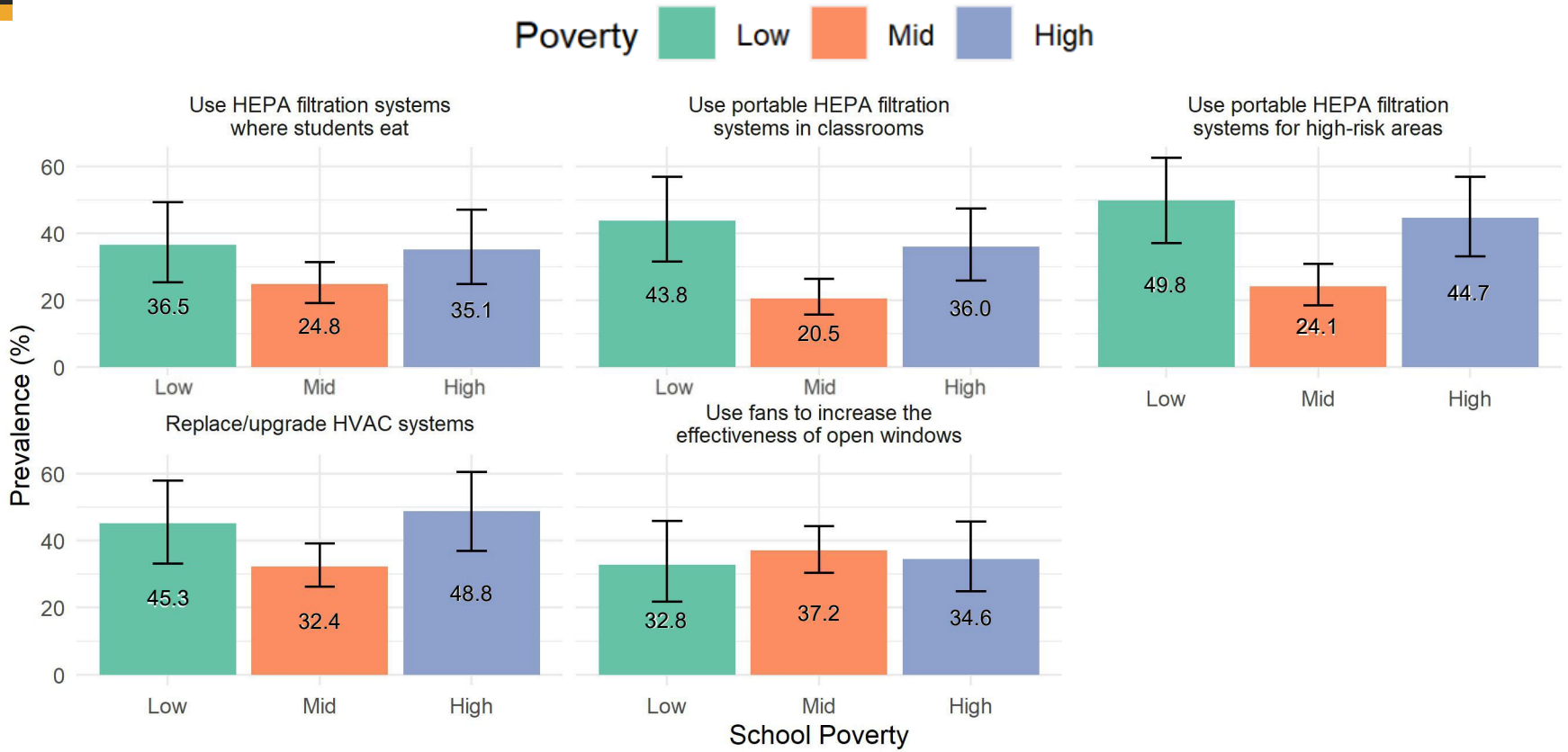
Mid-poverty schools less likely to relocate activities to outdoors when possible than high-poverty schools.

Ventilation in areas where students eat by school poverty

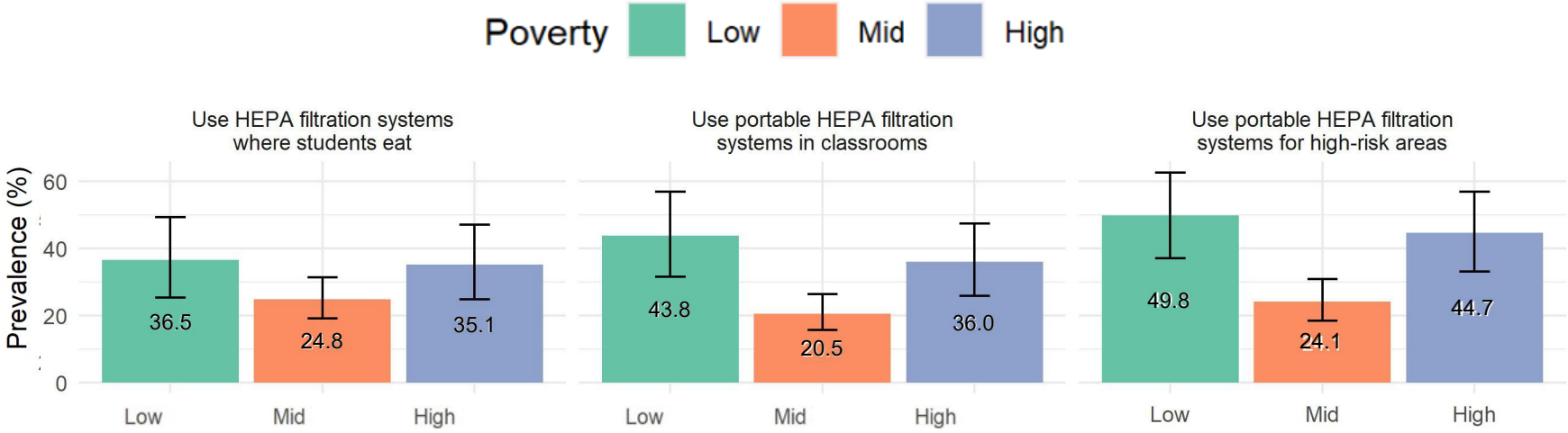


Mid-poverty schools less likely to increase ventilation in areas where students eat than high-poverty schools.

Differences in ventilation strategies by school poverty (2 of 2)

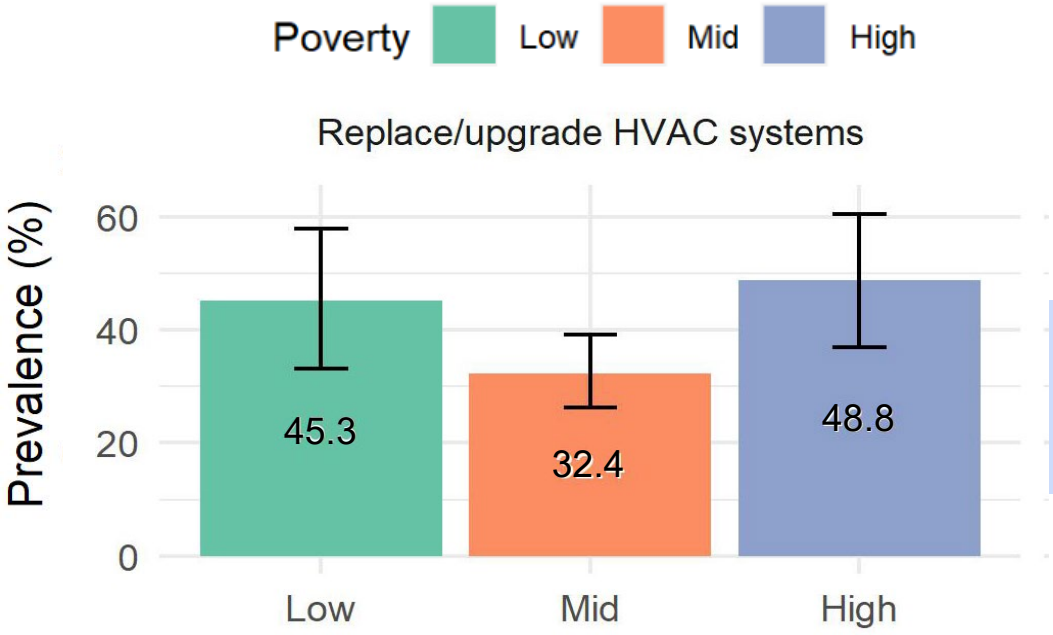


HEPA filtration systems by school poverty



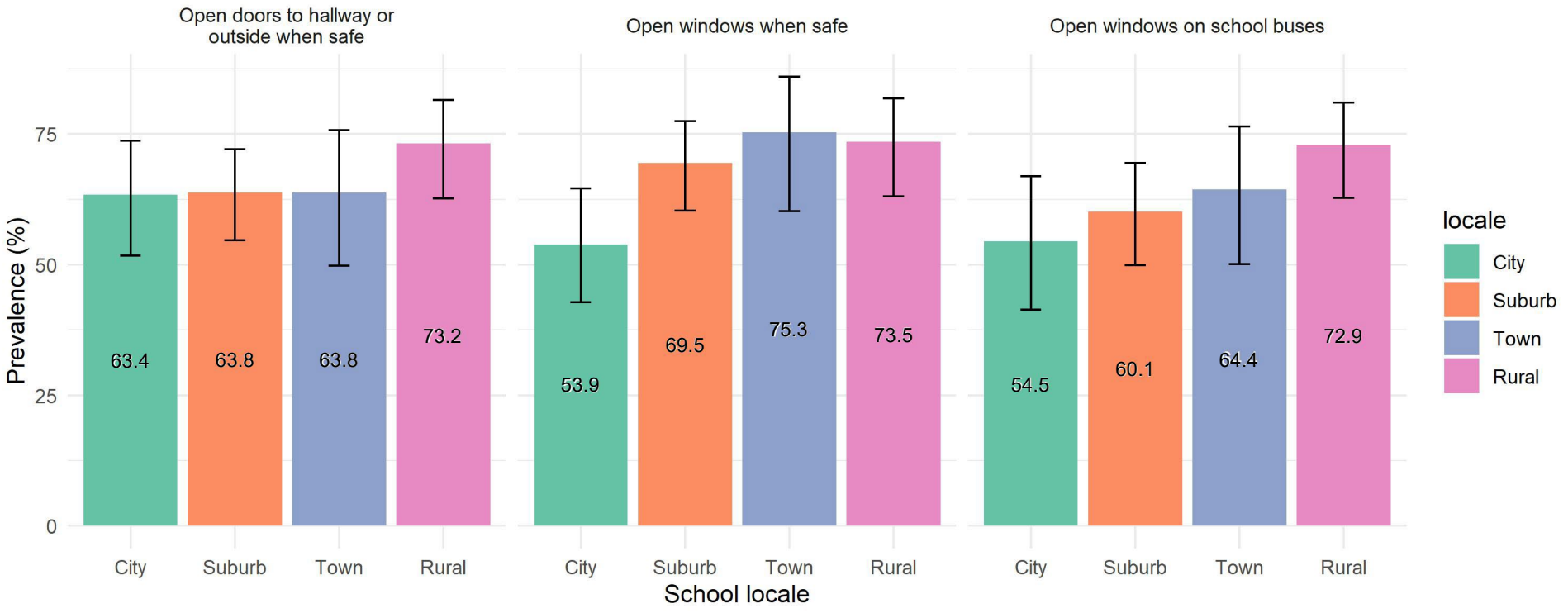
Mid-poverty schools least likely to implement several strategies relating to use of HEPA filtration systems.

Replace/upgrade HVAC systems by school poverty

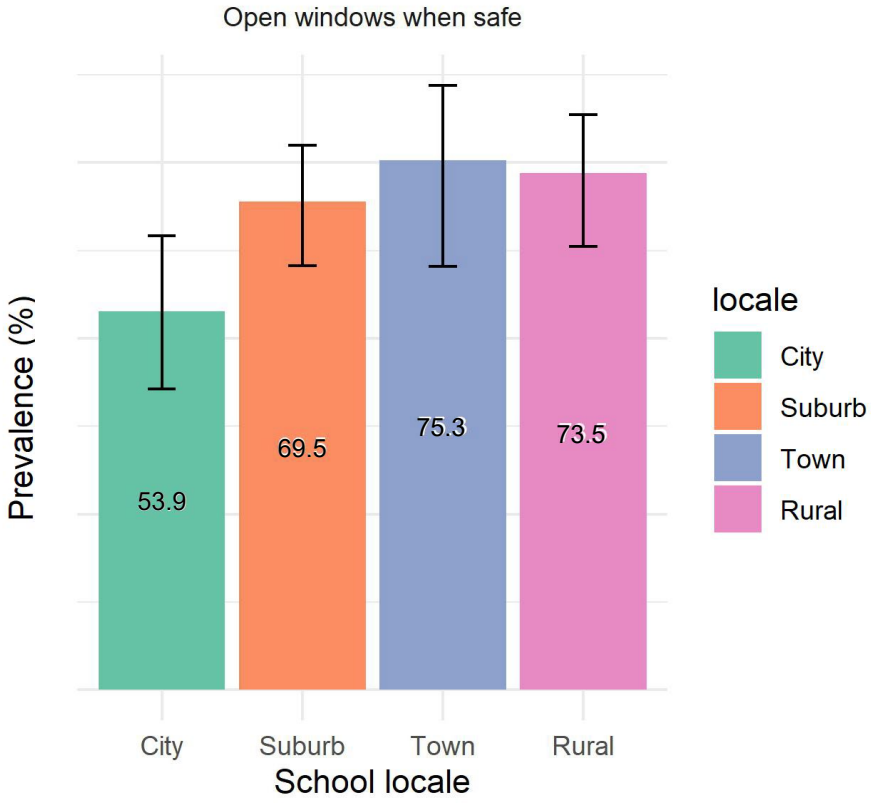


Mid-poverty schools less likely to replace/upgrade HVAC systems than high-poverty schools.

Differences in strategies relating to opening doors/windows by school locale

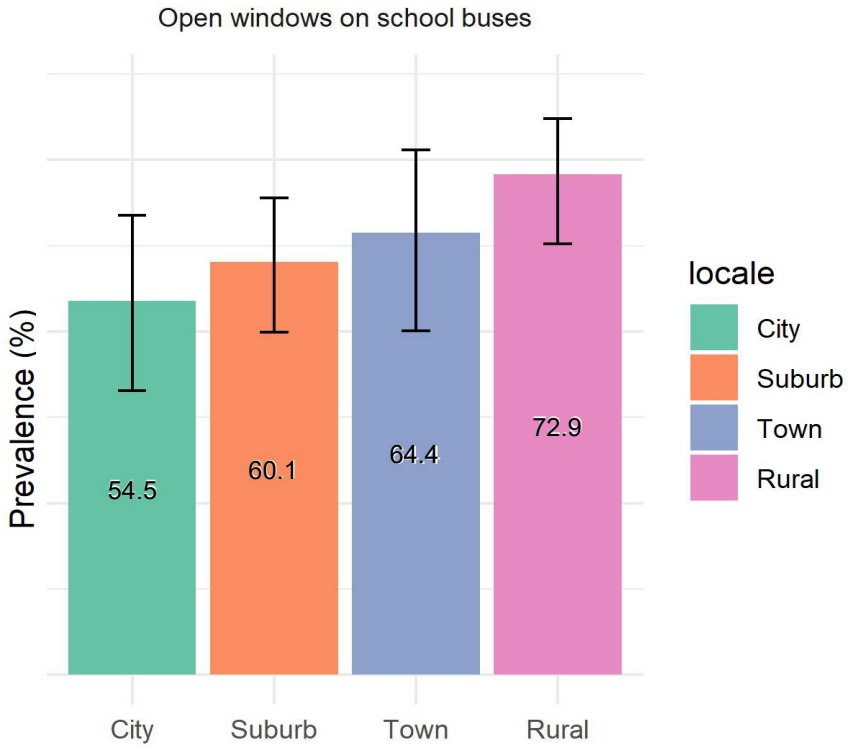


Opening windows by school locale



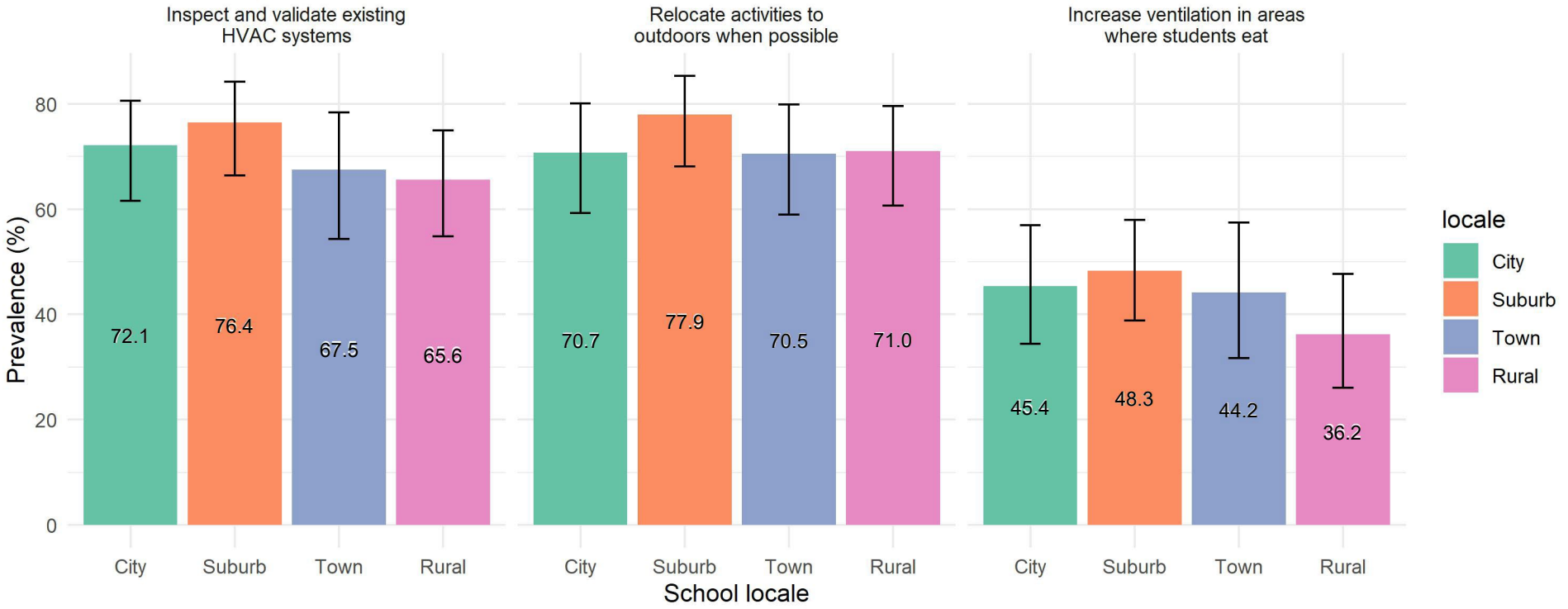
City schools were less likely to report opening windows than were suburban, town, and rural schools.

Opening school bus windows by school locale

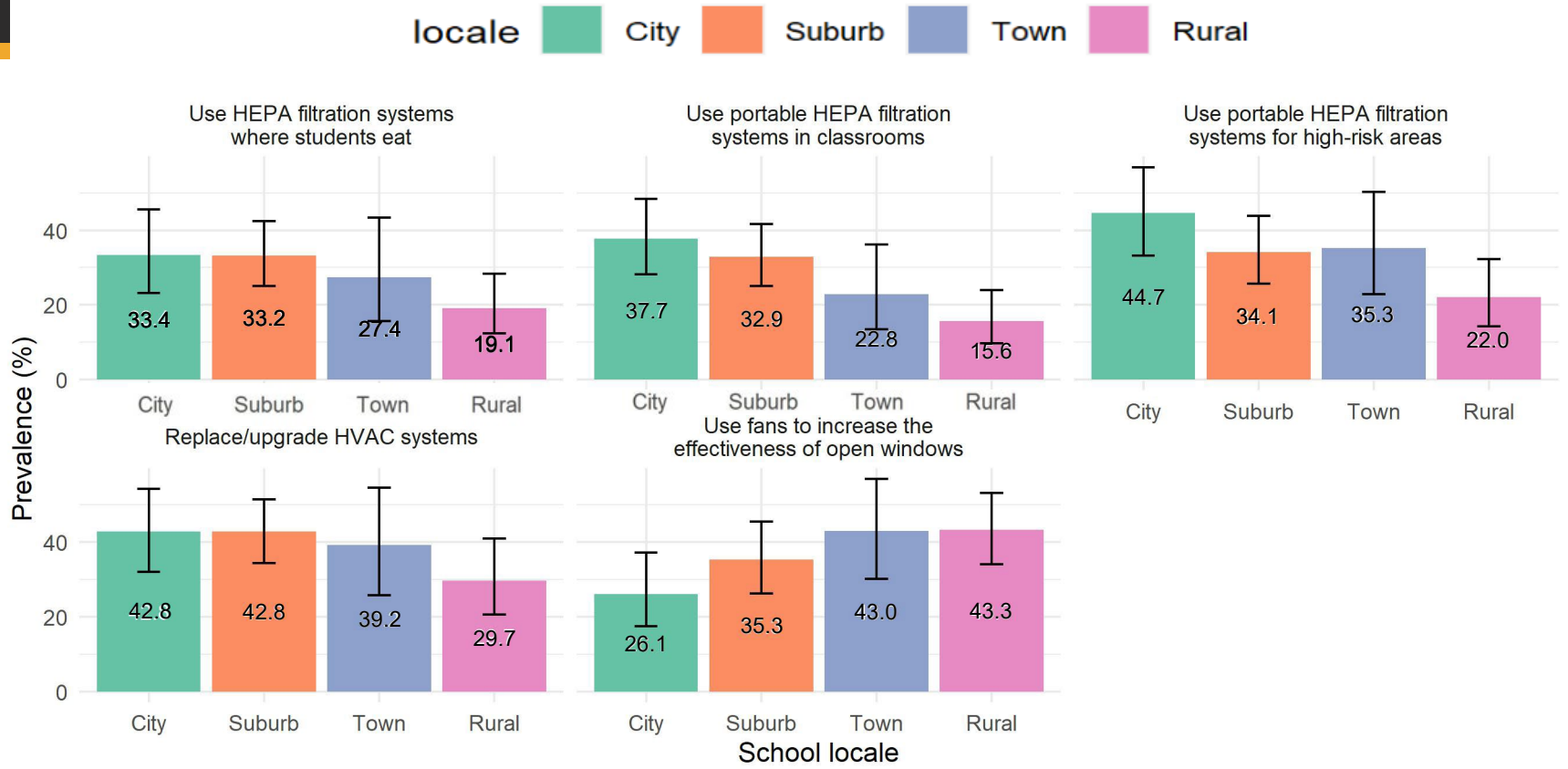


City schools were less likely to report opening windows on school buses than were rural schools.

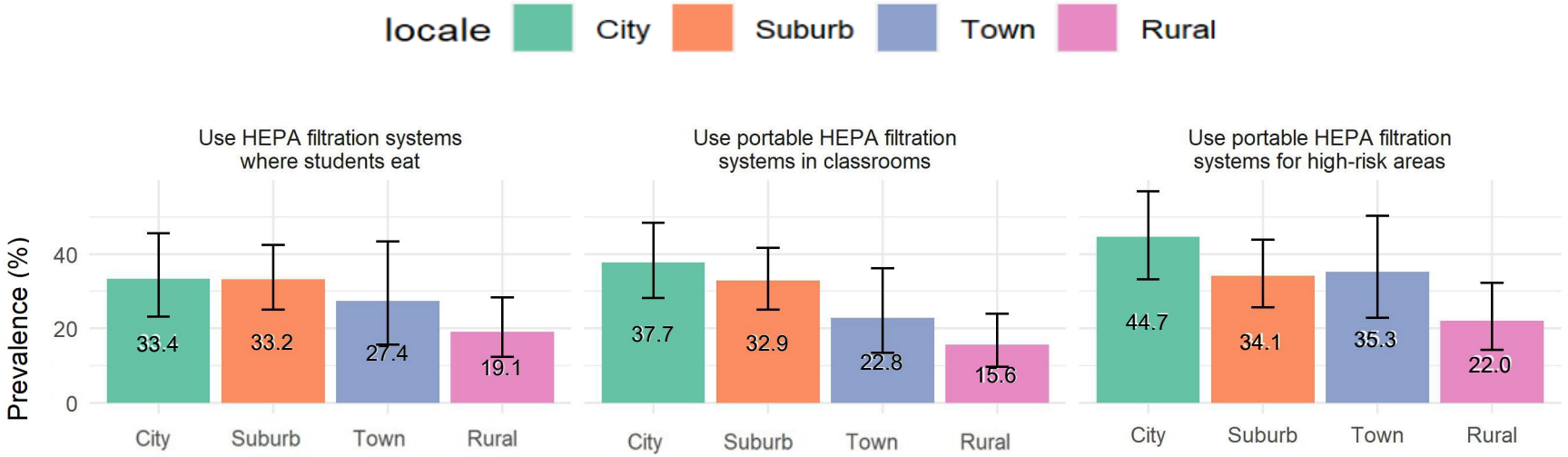
Differences in ventilation strategies by school locale (1 of 2)



Differences in ventilation strategies by school locale (2 of 2)

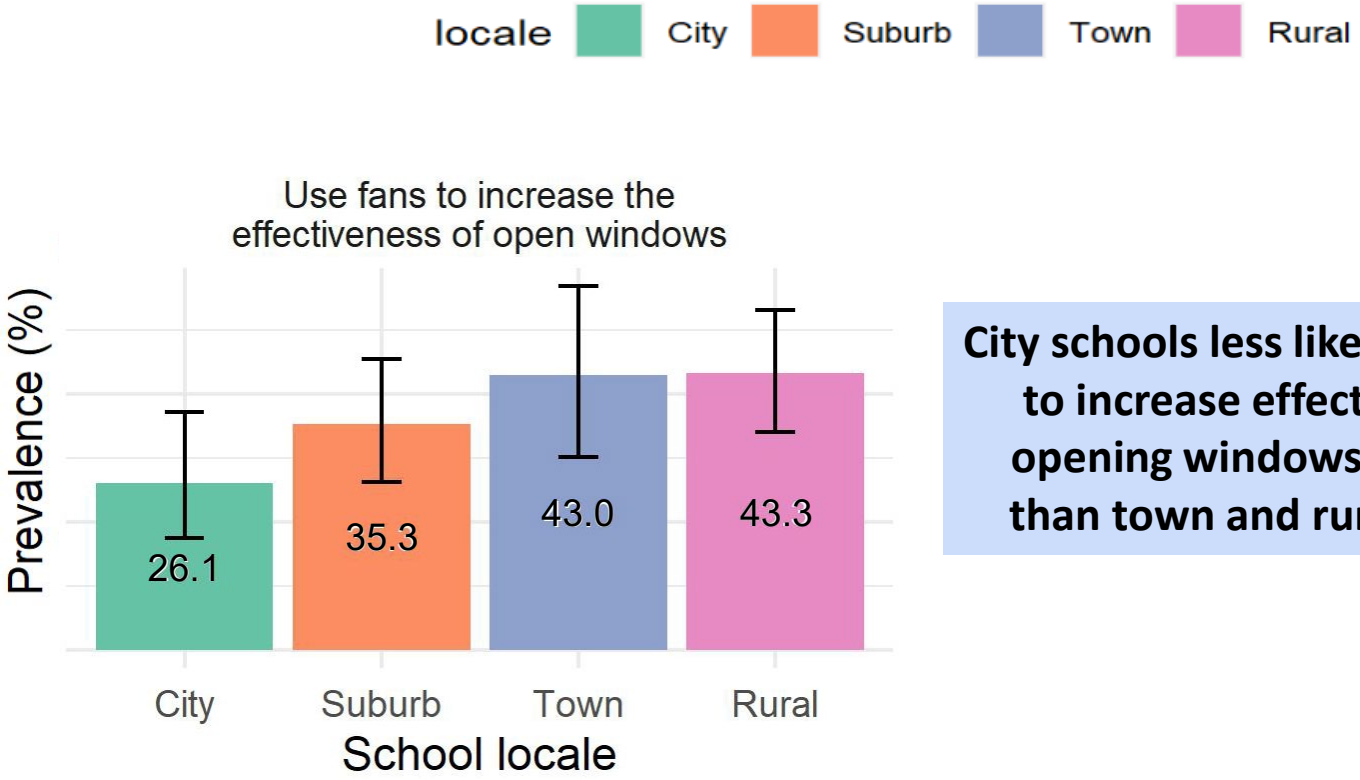


HEPA filtration systems by school locale



Rural schools least likely to implement several strategies relating to use of HEPA filtration systems.

Use of fans by school locale



City schools less likely to use fans to increase effectiveness of opening windows when safe than town and rural schools.

Conclusions and implications

- Mid-poverty and rural schools had lowest prevalence of higher-cost strategies to improve ventilation
- Ensure federal funds to improve ventilation in schools are used
- Address barriers schools experience in improving ventilation
  - Cost
  - Supply chain issues
  - Competing demands
- Identify facilitators
  - Federal funding
  - Buy-in from school districts
  - Summer break

Resources

- *MMWR* publication: http://dx.doi.org/10.15585/mmwr.mm7123e2
- CDC guidance for K-12 schools: https://www.cdc.gov/coronavirus/2019-ncov/community/schools-childcare/k-12-childcare-guidance.html
- CDC guidance for ventilation in schools and childcare programs: https://www.cdc.gov/coronavirus/2019-ncov/community/schools-childcare/ventilation.html
- Interactive school ventilation tool: https://www.cdc.gov/coronavirus/2019-ncov/community/schools-childcare/interactive-ventilation-tool.html

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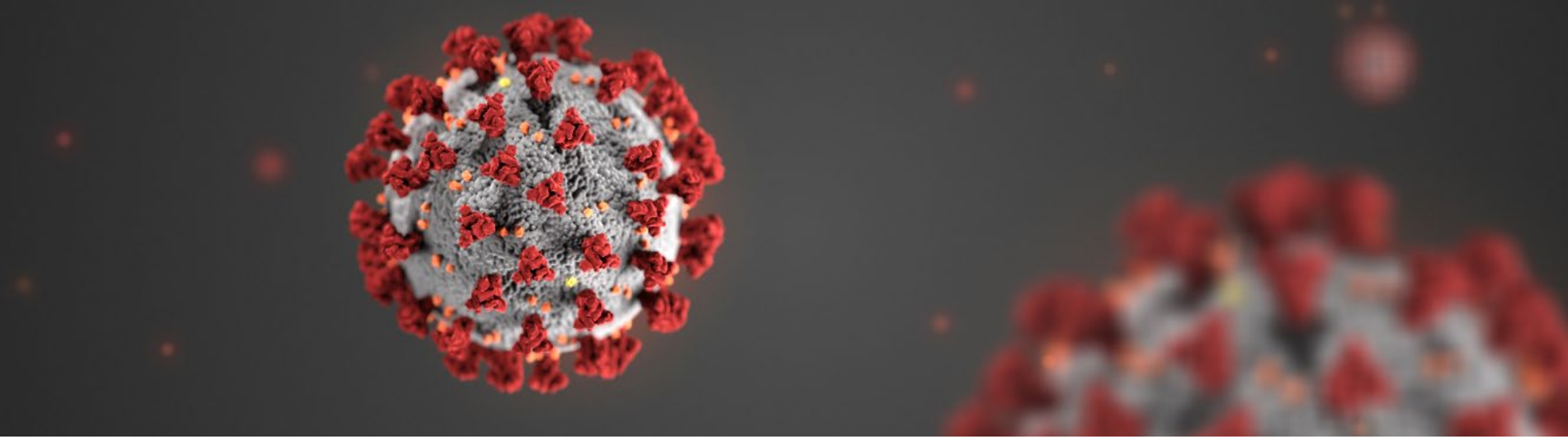
- India Rose



For more information, contact CDC
1-800-CDC-INFO (232-4636)
TTY: 1-888-232-6348 www.cdc.gov

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