

Classroom ventilation and illness absence in California elementary schools

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Background – Classroom ventilation rate (VR) standards are needed that adequately protect human health while minimizing unnecessary consumption of energy. While limited evidence suggests that lower VRs in school classrooms are associated with increased student absence and health effects, this relationship needs confirmation. We conducted a multi-year study to investigate associations between classroom ventilation rates and student absence (as an indicator for health).

Methods – This study included one school district in each of 3 major California climate regions; in each district, 9–10 schools across the socioeconomic range; and in each school, two each of 3rd, 4th, and 5th grade classrooms. Daily classroom VRs in each classroom were estimated using real time indoor CO₂ from web-connected sensors. School districts provided daily classroom illness absence and demographic data. We used adjusted zero-inflated negative binomial regression models to estimate relationships between classroom VRs (prior 7-day average) and daily illness-related absence.

Results – In the 162 studied classrooms in 28 schools in 3 districts, most VRs were lower than the CA standard of 7.1 L/s -person with 95% of VRs in the Central Valley district below the standard. Overall model estimates (**Figure 1**) showed a 1.6% decrease in illness absence per VR increase of 1 L/sec per person. Increasing the average California K-12 classroom VR up to the 7.1 L/s-person standard was associated with a 3.4% reduction in illness absence and, based on estimates of attendance-linked school revenues and energy costs of ventilation, \$33M in increased revenue to schools but only \$4M in higher energy costs. Higher VRs would provide additional estimated net benefits.

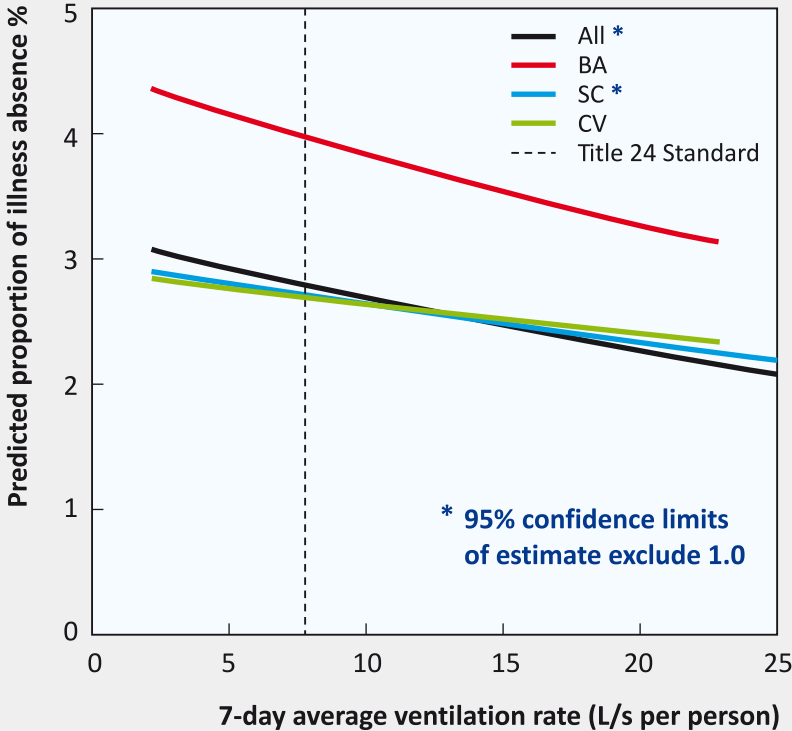


Figure 1. Estimated illness absence proportions at different ventilation rates in the three school districts (BA = Bay Area, SC = South Coast, CV = Central Valley and all).

Conclusion – Results of this study, using real-time measurements of classrooms in multiple climate regions of California, suggest that current classroom ventilation rates are usually below standards, and that increasing ventilation rates up to the current standards or higher would provide, in addition to health benefits to students, substantial economic benefits to schools, far exceeding increased energy costs. ■

This research note is based on the paper:
Mark J. Mendell, Ekaterina A. Eliseeva, Molly M. Davies, M. Spears, Agnes B. Lobscheid, William J. Fisk, and Michael G. Apte: Association of Classroom ventilation with reduced illness absence: a prospective study in California elementary schools. International Journal of Indoor Environment and Health, Indoor Air, 23:515-528, December 2013.