P34. Impact of COVID-19 prevention measures on CO_2 in a primary school – preliminary results

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Abstract

Schools are the most important indoor environment for children, apart from home, where they spent a great part of their time. The COVID-19 pandemic reinforced the importance of evaluating indoor air quality conditions in schools, making it necessary to improve ventilation when re-opening schools (Alonso et al., 2021; DGS, 2020). Moreover, CO_2 is often considered a useful indicator for adequate ventilation. Thus, based on the influence of airflow and environmental conditions in the transmissibility of COVID-19, this study aimed to quantify the difference between the CO_2 concentrations before and during the COVID-19 pandemic in two classrooms from a primary school in Porto (Portugal) using a low-cost sensing device.

This study occurred in two periods: in the early 2020 (before COVID-19 pandemic), and in the early 2021 (during COVID-19 pandemic), in two classrooms – S07_A and S07_B, which presented in both periods a similar school timetable and occupant density (0.30 and 0.45 occupants/m^2, respectively). However, natural ventilation patterns in classrooms have been improved between the two periods. After 2 consecutive weekdays of measurements against research-grade instrument for both periods, in the two classrooms ($r > 0.992$), the low-cost device AirVisual Pro was used to monitor CO_2 continuously during 41 days (2020) and 29 days (2021). To quantify the difference between CO_2 levels before and during the COVID-19 pandemic in both classrooms, two average periods were considered for the analysis: (i) an average day period (hourly means of all weekdays); and (ii) an average occupation period (hourly means during occupation periods considering the school timetable). Thus, descriptive statistical analysis, as well as normality (Shapiro-Wilk Test) and significance (Wilcoxon Signed Rank Test) tests were performed using the R software version 4.0.5. The level of statistical significance was set at 0.05.

The reference values of the Portuguese legislation were exceeded in ~67% (S07_A) and ~56% (S07_B) of the occupation before COVID-19 pandemic, i.e. without applying the prevention measures. Also, a positive improvement was found for both classrooms during the COVID-19 pandemic since CO_2 concentrations decreased to levels below of the reference values (2250 mg/m^3). Moreover, a statistically significant reduction (p-value < 0.05) on CO_2 concentrations from 2020 to 2021 were achieved in the two studied classrooms for both average day (mean difference of -553 mg/m^3 and -313 mg/m^3 for S07_A and S07_B, respectively) and average occupation periods (mean difference of -1200 mg/m^3 and -643 mg/m^3 for S07_A and S07_B, respectively). Therefore, it is possible to conclude that even with a simple and low-cost prevention measure (increasing the natural ventilation) had a great impact on CO_2 concentrations, suggesting that the same could happen for other indoor air pollutants. These measures may also be able to reduce the risk of COVID-19 airborne transmission. Thus, as a future work it is recommended to extend this analysis to other pollutants and more microenvironments, as well as to infer the risk of COVID-19 airborne transmission based on CO_2 levels.

Keywords: Indoor air quality, school, COVID-19, CO_2, low-cost sensor.

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