UNIVERSITY OF TORONTO | Civil + Mineral Engineering

Diaz Lozano Patino E, Siegel JA. 2018. Indoor environmental quality in social housing: A literature review. *Building and Environment* **131** 231–241.

Abstract

The unprecedented levels of urbanization in the last century have led to significant social housing populations in cities across the world. Housing conditions in social housing units are usually substandard, which often correlates with higher exposure to indoor pollutants, and ultimately negative health effects. We reviewed 49 articles in the literature documenting indoor environmental quality (IEQ) conditions in social housing which were focused on air pollutant concentrations, thermal comfort, or health effects associated with living in these units. We found evidence that social housing residents may be disproportionately exposed to higher levels of $PM_{2.5}$, which is heavily influenced by the presence of cigarette smoking in the building. However, we found no evidence that they are disproportionately exposed to higher levels of other pollutants such as formaldehyde and dampness. Poor thermal comfort was also found to be a prevalent issue in social housing, but there are not enough data on comparable non-social housing to make a definitive statement about relative prevalence. We also found that there are strong indicators that residing in social housing is associated with negative health effects, with high prevalence of respiratory problems. we found that green retrofits have the potential to improve the IEQ conditions, but these retrofits must be tailored to the specific context of each building. Given the increasing importance of social housing to most urban areas, and the potential vulnerability of social housing inhabitants, it is imperative that we maintain healthy environments for these occupants.

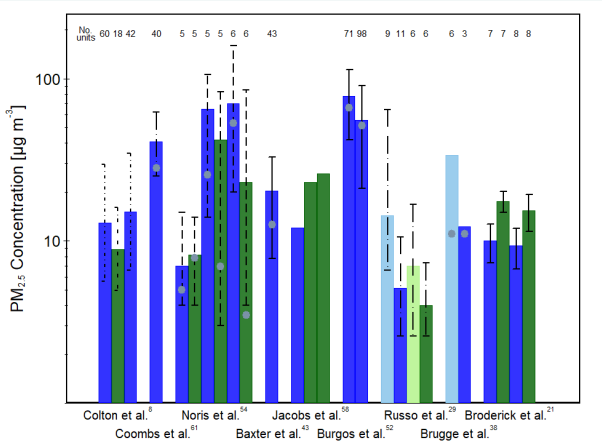

Figure 1 $PM_{2.5}$ concentrations reported in the literature. Blue bars are suites before retrofits were undertaken. Green bars are suites after retrofits were undertaken. Light blue and light green indicate that smoking was present. Gray dots represent outdoor concentrations. Dashed lines represent range (min-max), continous lines represent one standard deviation, long dashed lines represent the interquartile range and short dashed lines represent one geometric standard deviation. There is wide variation of concentrations between and across studies, and that smoking suites have higher concentrations that non-smoking suites in the same study. The magnitude and sign of the impact of green retrofits is varied.

Main findings

1. Social housing residents are at an increased risk of exposure to $PM_{2.5}$. Smoking was identified as an important source of $PM_{2.5}$
2. Pests are a common problem in social housing, which results in increased exposure to allergens as well as increased use of harmful pesticides
3. Social housing residents may be at higher risk of exposure to nitrogen dioxide due to use of gas ovens for supplementary heating
4. There is no evidence in the reviewed literature that social housing residents are disproportionally exposed to formaldehyde and dampness
5. There are established correlations between residing in social housing and the development or exacerbation of negative health outcomes, asthma in particular
6. Green retrofits have the potential to reduce exposure and improve health, but there have also been cases in which they increase pollutant concentrations.
7. Smoking bans and integrated pest management were commonly reported as effective measures to reduce exposure to $PM_{2.5}$ and pesticides

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