

Research brief

Indoor Particulate Matter Concentration Variations and Associations with Indoor/Outdoor Temperature in Rural Limpopo

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<https://doi.org/10.17159/2410-972X/2019/v29n1a4>

The World Health Organization (WHO) reports that, worldwide, approximately 50% of all households and 90% of rural households burn solid fuels as a primary source of energy. In South Africa, data collected during a national census showed that a high proportion of the population use wood, coal or animal dung as fuel for cooking and space heating, the majority of whom reside in rural areas. During the combustion of solid fuels indoors, high concentrations of particulate matter (PM) are released inside the dwellings. Therefore, occupants are exposed to significant health risks that result from personal exposure to PM. This study assessed indoor air quality in rural Giyani, situated in the Limpopo province of South Africa, by monitoring indoor PM₄ concentrations, temperature and relative humidity. These were recorded daily in summer (February), spring (September) and winter (July).

Measured PM₄ concentrations displayed seasonal variation with concentrations being higher in winter compared to spring and summer (Figure 1). Increased burning/heating activities during winter periods leads to increased ambient concentrations that are contributing to increased levels of PM exposure indoors. Reduced ventilation by closing windows and doors to keep warm during winter also likely trapped PM₄ inside thus increasing the indoor concentrations. Daily indoor PM in winter and spring exceeded concentration standards and guidelines, namely South Africa's National Ambient Air Quality Standards (NAAQS) and those of the WHO. A distinct diurnal pattern in PM concentrations was observed during the study period with peaks occurring in the early mornings and evenings. These coincided with the times of the day during which combustion for cooking and space heating usually occurred. Results also showed that measured indoor temperatures were extremely high. Household occupants are therefore vulnerable to heat-related illnesses due to exposure to elevated temperature.

Our results suggested a strong seasonal variability in PM₄, with diurnal variability being highest in winter. Also, exposure to peak PM₄ values largely occurred during winter due to the

high indoor PM₄ concentrations. Conversely, during summer, indoor temperatures exceeded thresholds recommended by epidemiological studies therefore occupants were at risk of negative health effects caused by high temperatures. These include the onset of heat-related illnesses as well exacerbation of existing chronic health conditions. Study findings suggest that intervention is required to reduce the use of biofuels indoors as well as community-level policies, education programmes and other relevant initiatives relating to awareness of heat-health outcomes.

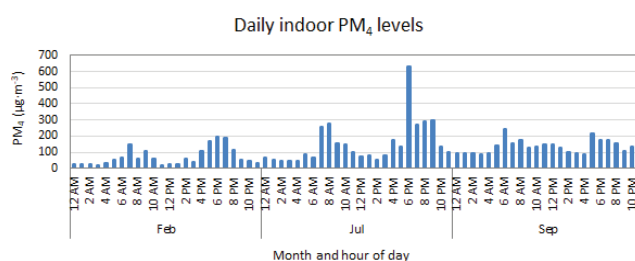


Figure 1: Averages of hourly indoor concentrations of PM₄ during summer, winter and spring.

Reference

Kapwata T, Language B, Piketh S and Wright CY. Variation of indoor particulate matter concentrations and association with indoor/outdoor temperature: a case study in rural Limpopo, South Africa. *Int J Environ Res and Pub Health* 2018, 9: 124.