

Second-Hand Smoke Exposure (Shs) in Air-Conditioned Offices and Its Effects on Non-Smoker Occupants

Nurul Hazwani Mohd Khairul Zain^a, Ismaniza Ismail^{a*}

Structured Abstract

Background: Exposure to second-hand smoke (SHS) presented considerable health risks to non-smokers, especially in indoor settings where ventilation systems and building design play a crucial role in the pollutants accumulation. This study investigated the effects of SHS on indoor air quality (IAQ) and the health of non-smokers in air-conditioned office buildings.

Methods: A cross-sectional study was employed, with data collected from two buildings in Shah Alam, Malaysia which were Shah Alam Gallery (restricted) and Sultan Alam Shah Museum (unrestricted). Pollutants such as PM_{2.5}, PM₁₀, CO, CO₂, TVOCs, and formaldehyde were measured using environmental monitoring equipment and formaldehyde meter, while SHS exposure within the occupants was evaluated through questionnaires.

Results: The findings revealed that both buildings contained SHS-related pollutants, though the levels within the buildings were different due to variations in smoking policies and ventilation efficiency. Concentrations of PM_{2.5}, PM₁₀ and CO were comparable in both buildings ($p > 0.05$), likely due to shared similarities in SHS exposure, ventilation systems efficiency and outdoor air infiltration. However, Sultan Alam Shah Museum recorded significantly higher CO₂ levels ($p < 0.001$), indicating insufficient ventilation and higher exposure to SHS. In contrast, Shah Alam Gallery had elevated levels of TVOCs ($p < 0.001$) and formaldehyde ($p = 0.006$), most likely attributed to emissions from indoor materials. Statistical analysis identified significant associations between SHS exposure, pollutant levels, and participants' perceptions of IAQ. Smoking policies, outdoor SHS exposure, and ventilation systems were found to be key factors influencing IAQ and SHS infiltration. Participants reported health issues such as coughing, respiratory irritation, and worsened asthma symptoms, with a higher prevalence in Sultan Alam Shah Museum, where the IAQ was poorer.

Conclusion: The study concluded that SHS exposure significantly affect IAQ and non-smoker's health, even in buildings with smoking restrictions. To reduce these risks, stricter enforcement of smoking policies, relocation of outdoor smoking areas, and improvements to ventilation systems are recommended. These findings highlight the need for comprehensive measures to control SHS exposure and safeguard non-smokers in confined workplace environments.

Keywords: Indoor Air Quality, Second-hand Smoke, Air-conditioned Workplaces, Non-Smoker, Tobacco Smoke.

*Correspondence: ismaniza@uitm.edu.my

^a School of Chemistry & Environment, Faculty of Applied Sciences, Universiti Teknologi MARA, Shah Alam, Malaysia