Indoor particulate matter heavy metals and their potential health risks in low socio-economic communities

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BACKGROUND
There is growing evidence that, pollutants such as particulate matter and heavy metals are associated with significant health impacts. The aim of this study was to identify the predictors and common sources of indoor $PM_{2.5}$ heavy metals and evaluate the health risk to the children living in Durban.

METHODOLOGY
Thirty households belonging to mothers participating in the mother and child in the environment birth cohort study were selected for this study. Airmetrics MiniVol samplers loaded with Teflon membrane filters were used for sampling airborne indoor $PM_{2.5}$. A wavelength-dispersive x-ray fluorescence technique was used to assess the number of heavy metals in the filters. Contamination levels were evaluated using contamination factor (CF), enrichment factor (EF), and pollution load index (PLI). Multivariate linear regression models were used to identify the predictors of indoor $PM_{2.5}$ heavy metals. The common sources of $PM_{2.5}$ heavy metals were identified using Pearson correlation and principal component analysis. The measured concentrations of metals were used to estimate the health risk for children.

RESULTS
According to CF, EF and PLI contamination exist in the assessed homes. Proximity to industry, wall type, age of the house, presence of windows, and proximity to pollution generating activities were associated with an increase in the levels of some indoor $PM_{2.5}$ heavy metals. Cross ventilation was associated with a reduction in indoor $PM_{2.5}$ As and Cu levels. The use of Pearson correlation and principal component analysis point to the potential roles of household characteristics, traffic emissions, industries, and natural sources. The health index was >1, and the cancer risk values in $PM_{2.5}$ As and Pb exceeded the maximum acceptable level of carcinogenic risk for humans.

CONCLUSIONS
This study highlights the potential contribution of heavy metals to indoor $PM_{2.5}$ toxicity. To protect vulnerable groups from exposure to heavy metals, it is necessary to prevent exposure to high-risk metals.
ADVOCASY MESSAGE: To protect children from exposure to heavy metals, environmental health policies related to indoor air quality need to be developed, especially in communities situated near industrial operations.

Keywords: indoor air pollution, heavy metals, children's environmental health