

Spatial patterns of personal exposure to particulate pollution in Accra neighborhoods

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Background and Aims

Spatial and temporal patterns of particulate matter (PM) pollution in cities of developing countries differ from those in high-income countries due to differences in sources. While recent studies have assessed the spatial patterns of PM pollution in developing country cities, little is known about personal exposure to PM and how it is affected by ambient concentration and time-location-activity budgets. Our aim was to characterize the spatial patterns of exposure to fine PM for students in four Accra neighborhoods.

Methods

We measured 24-hour integrated and continuous PM_{2.5} exposure for 52 students in four neighborhoods of Accra. Exposure was measured by the subject wearing a backpack fitted with portable PM monitors and GPS units. We concurrently measured ambient PM_{2.5} at fixed monitoring sites in the four neighborhoods. Questionnaires were used to collect additional information about kitchen characteristics, household fuel use and exposure behaviors.

Results

Mean personal 24-hr exposure concentration of the students was 94 $\mu\text{g}/\text{m}^3$, ranging between 26 $\mu\text{g}/\text{m}^3$ and 283 $\mu\text{g}/\text{m}^3$. Mean exposures by neighborhood were between 70 and 126 $\mu\text{g}/\text{m}^3$. The correlation between average ambient concentrations and average personal exposure concentrations was 0.39.

Conclusion

School children's exposure to PM_{2.5} in Accra neighborhoods is substantially higher than WHO Air Quality Guidelines. Epidemiological studies of air pollution health effects need to use exposure indicators that account for its spatial patterns.