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# Environmental exposure disparities in urban markets: A Comparative air quality assessment in Lusaka, Zambia.

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Background and study objective: To quantify PM2.5 and PM10 exposure differences between market infrastructure types and characterize temporal patterns.
Methods: Two low-cost PurpleAir sensors were installed to continuously monitor PM2.5 and PM10 concentrations for 8-week weeks (May 25–July 9, 2025), during dry season, in the exposed and control markets. Measurements were recorded every 2 minutes between 7 am and 7 pm. Data analysis synchronized monitoring periods when all sensors were active to minimize temporal confounding. Welch's two-sample t-tests were conducted, with statistical significance, $p<0.05$.
Results: Total 16,079 observations were recorded. Exposure sites demonstrated significantly higher mean concentrations of PM2.5 (32.7 versus 27.6 μg/m³; difference: 5.1 μg/m³; 95% CI: 3.9–6.2; $t = 8.63$, $p < 0.001$) and PM10 (44.4 versus 33.3 μg/m³; difference: 11.1 μg/m³; 95% CI: 9.7–12.6; $t = 15.05$, $p < 0.001$) compared to control sites, an increase of 18.5% and 33.3%, respectively. PM2.5 levels at exposure sites exceeded the WHO 24-hour guideline value (15 μg/m³) by 118%. Diurnal patterns were observed at both locations, peak concentrations occurred mid-afternoon.
Conclusion: PM2.5 concentrations were significantly higher in unpaved, high-traffic market environments.

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