

Put Your Money Where the (Gas) Stove Fits: Using Household Air Pollution Measurements to Prioritize Locations for Clean Cooking Intervention in Sub-Saharan Africa*

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Background. Cleaner cooking fuels like liquefied petroleum gas (LPG) emit less fine particulate matter $PM_{2.5}$ and carbon monoxide (CO) than polluting fuels (e.g. wood, charcoal). Yet, some clean cooking interventions have not achieved substantial exposure reductions.

Methods. The CLEAN-Air(Africa) study measured 24-hour $PM_{2.5}$ and CO kitchen concentrations (n=262), and female cook (n=223)/child (n=119) exposures in peri-urban Kenya, Ghana and Cameroon among households cooking primarily with LPG, wood or charcoal. Stove use monitoring was used to derive mean 'cooking' and 'non-cooking' $PM_{2.5}$ and CO levels.

Results. The mean 24-hour $PM_{2.5}$ kitchen concentration among households cooking with charcoal (317 $\mu\text{g}/\text{m}^3$) was quintuple that among households using LPG (61 $\mu\text{g}/\text{m}^3$) in Kenya, but only 2 $\mu\text{g}/\text{m}^3$ higher in Ghana (56 versus 54 $\mu\text{g}/\text{m}^3$, respectively). The mean CO kitchen concentration in households cooking with charcoal was twice the WHO guideline (7 ppm) in Kenya (15.81 ppm) but below the guideline in Ghana (1.77 ppm). The mean $PM_{2.5}$ kitchen concentration among households using wood in Cameroon was four times higher while cooking (811 $\mu\text{g}/\text{m}^3$) than not cooking (202 $\mu\text{g}/\text{m}^3$). Among households using charcoal in Ghana, the mean $PM_{2.5}$ kitchen concentration was lower when cooking (42 $\mu\text{g}/\text{m}^3$) than not cooking (67 $\mu\text{g}/\text{m}^3$). Mean $PM_{2.5}$ cook exposures only met the WHO interim-1 target (35 $\mu\text{g}/\text{m}^3$) among LPG users staying indoors and living >10 minutes from a road.

Conclusions. Clean cooking interventions should be prioritized in certain sub-Saharan African communities to increase the likelihood of $PM_{2.5}$ exposure reductions and associated health benefits.

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