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**SUPPLEMENTARY MATERIAL**

**EXPOSURE TO HOUSEHOLD AIR POLLUTION FROM BIOMASS COOKSTOVES AND BLOOD PRESSURE AMONG WOMEN IN RURAL HONDURAS: A CROSS-SECTIONAL STUDY**

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**Supplemental Information: Black Carbon Estimation**

We estimated PM2.5 black carbon concentrations based on the optical transmission of light through the air sampling filters. A transmissometer (model OT-21, Magee Scientific, USA) estimated the attenuation at 880 nm light intensity through the sample filter, which is proportional to the amount of black carbon on the filter. To estimate the black carbon loading we first define a measure of attenuation (ATN) as the natural log of the ratio of light transmittance of a reference filter (I0) to a sample filter (I) multiplied by 100:

(1)

We used a single value for reference transmittance (I0 = 224571), taken as the average transmittance of 54 field blank filters. This reference method is similar to that reported previously with laboratory blank filters1 and one that also allows us to account for contamination that may have occurred with filter handling during non-sampling periods. Although these field blanks were not collected during the same sampling period, samples were collected within a year and with similar field methods.

The measured attenuation was then used to derive the attenuation coefficient (batn) in units of inverse megameters (Mm-1), adjusting for field sampling factors such as the sampled area on the filter (m2), and the volume of the air sampled (m3, calculated using the sample flow rate and the sample duration). The attenuation coefficient was calculated as described by Presler-Jur et al:1

 (2)

Assumptions of black carbon concentration estimates have uncertainties given the properties of particles (e.g. differences in light scattering and combustion source). We used a mass attenuation cross-section), σatn, to convert from ATN to an equivalent BC concentration, which implies a linear relationship between the BC and the ATN of the sample filter. To account for the primarily wood-burning nature of the exposure, we defined σatn = 12.5 m2/g as derived previously for carbonaceous smoke by Chylek and colleagues.2 Additionally, previous studies have demonstrated a measurement artifact wherein an underestimation of the ATN becomes more pronounced at higher black carbon concentration. We therefore used a loading correction r, calculated according Kirchstetter and Novakov:3

 (3)

The final estimated BC concentration (BC, μg/m3) was calculated as follows:

 (4)

**SUPPLEMENTAL TABLES**

**Supplementary Table 1.** Adjusted mean differences in diastolic blood pressure (mmHg) comparing continuous (natural log transformed) pollution concentrations and stove types among 147 Honduran women using either a traditional or *Justa* stove\*

|  |  |
| --- | --- |
| **24-hour average air pollution concentrations1** | **Adjusted mean difference (mmHg) in diastolic blood pressure (95% CI)** |
| Personal PM2.5 (μg/m3) (n=104) | 0.4 (-2.0 to 2.7) |
| Kitchen PM2.5 (μg/m3) (n=105) | 1.5 (0.2 to 2.8) |
| Personal BC (μg/m3) (n=105) | 0.03 (-1.2 to 1.2) |
| Kitchen BC (μg/m3) (n=106) | 0.8 (-0.2 to 1.8) |
| **Stove type** |  |
| Stove type:  Traditional stove (n=74) *Justa* stove (n=72) | 1.3 (-1.5 to 4.1)Reference |
| Stove type:  Traditional with use of a secondary stove (n=27)  Traditional only (n=47) *Justa* with use of a secondary stove (n=34) *Justa* only (n=38) | 2.2 (-1.4 to 5.9)2.2 (-2.2 to 6.5)2.0 (-2.0 to 6.0)Reference |
| Stove type:  Traditional only (n=74) *Justa* installed ≥19 months ago (n=36) *Justa* installed <19 months ago (n=36) | 2.8 (-0.6 to 6.2)3.0 (-1.0 to 6.9)Reference |

BC=black carbon; CI=confidence interval; PM=particulate matter<2.5 μm.

**\***Adjusted for: age (continuous), beds per person (continuous) or total material wealth (categorical), body mass index (continuous), physical activity (continuous).

1 Per one unit increase in natural log transformed air pollution concentration.

**Supplementary Table 2.** Effect modification by age for the adjusted mean differences in diastolic blood pressure (mmHg) comparing continuous (natural log transformed) pollution concentrations and stove types among 147 Honduran women using either a traditional or *Justa* stove\*

|  |  |  |  |
| --- | --- | --- | --- |
| **24-hour average air pollution concentrations1** | **Age category** | **Adjusted mean difference in diastolic blood pressure (95% CI)** | **P-value for interaction** |
| Personal PM2.5 (μg/m3) (n=104) | ≥40 years (n=35)<40 years (n=69) | 3.4 (-0.7 to 7.4)-1.0 (-3.9 to 1.8) | 0.09 |
| Kitchen PM2.5 (μg/m3) (n=105) | ≥40 years (n=36)<40 years (n=69) | 3.0 (0.9 to 5.0)0.4 (-1.3 to 2.1) | 0.06 |
| Personal BC (μg/m3) (n=105) | ≥40 years (n=35)<40 years (n=70) | 1.0 (-0.9 to 2.9)-0.4 (-1.8 to 1.1) | 0.27 |
| Kitchen BC (μg/m3) (n=106) | ≥40 years (n=36)<40 years (n=70) | 1.6 (-0.1 to 3.3)0.3 (-1.0 to 1.6) | 0.22 |
| **Stove type (Traditional vs. *Justa*)** | ≥40 years (n=52)<40 years (n=95) | 1. (0.6 to 1.6)

1.1 (0.8 to 1.5) | 0.46 |

BC=black carbon; CI=confidence interval; PM=particulate matter<2.5 μm.

**\***Adjusted for: age (continuous), beds per person (continuous) or total material wealth (categorical), body mass index (continuous), physical activity (continuous).

1 Per one unit increase in natural log transformed pollution concentration.

**Supplementary Table 3.**  Effect modification by body mass index for the adjusted mean differences in systolic blood pressure (mmHg) comparing continuous (natural log transformed) pollution concentrations and stove types among 147 Honduran women using either a traditional or *Justa* stove\*

|  |  |  |  |
| --- | --- | --- | --- |
| **24-hour average air pollution concentrations1** | **Body mass index (BMI) category** | **Adjusted Mean Difference Systolic Blood Pressure (95% CI)** | **p-value for interaction** |
| Personal PM2.5 (μg/m3) (n=104) | ≥25 BMI (n=54)<25 BMI (n=50) | 0.4 (-3.8 to 4.5)1.7 (-2.4 to 5.7) | 0.67 |
| Kitchen PM2.5 (μg/m3) (n=105) | ≥25 BMI (n=56)<25 BMI (n=49) | 2.4 (0.1 to 4.7)2.3 (-0.5 to 5.1) | 0.97 |
| Personal BC (μg/m3) (n=105) | ≥25 BMI (n=55)<25 BMI (n=50) | 0.6 (-1.4 to 2.6)0.7 (-1.4 to 2.8) | 0.91 |
| Kitchen BC (μg/m3) (n=106) | ≥25 BMI (n=56)<25 BMI (n=50) | 2.0 (0.3 to 3.7)1.1 (-0.9 to 3.1) | 0.51 |
| **Stove type (Traditional vs. *Justa*)** | ≥25 BMI (n=73)<25 BMI (n=74) | 1.0 (0.7 to 1.6)1.3 (1.0 to 1.7) | 0.12 |

BC=black carbon; CI=confidence interval; PM=particulate matter<2.5 μm.

**\***Adjusted for: age (continuous), beds per person (continuous), body mass index (continuous), physical activity (continuous).

1 Per one unit increase in natural log transformed pollution concentration.

**Supplementary Table 4.**  Effect modification by body mass index for the adjusted mean differences in diastolic blood pressure (mmHg) comparing continuous (natural log transformed) pollution concentrations and stove types among 147 Honduran women using either a traditional or *Justa* stove\*

|  |  |  |  |
| --- | --- | --- | --- |
| **24-hour average air pollution concentrations1** | **Body mass index (BMI) category** | **Adjusted Mean Difference Diastolic Blood Pressure (95% CI)** | **p-value for interaction** |
| Personal PM2.5 (μg/m3) (n=104) | ≥25 BMI (n=54)<25 BMI (n=50) | 1.4 (-1.9 to 4.8)-0.1 (-3.4 to 3.2) | 0.51 |
| Kitchen PM2.5 (μg/m3) (n=105) | ≥25 BMI (n=56)<25 BMI (n=49) | 1.5 (-0.2 to 3.3)1.3 (-0.8 to 3.4) | 0.84 |
| Personal BC (μg/m3) (n=105) | ≥25 BMI (n=55)<25 BMI (n=50) | 0.4 (-1.2 to 2.0)-0.1 (-1.8 to 1.6) | 0.67 |
| Kitchen BC (μg/m3) (n=106) | ≥25 BMI (n=56)<25 BMI (n=50) | 1. (-0.3 to 2.4)

 0.6 (-1.0 to 2.1) | 0.66 |
| **Stove type (Traditional vs. *Justa*)** | ≥25 BMI (n=73)<25 BMI (n=74) | * 1. (0.7 to 1.6)

1.1 (0.8 to 1.5) | 0.72 |

BC=black carbon; CI=confidence interval; PM=particulate matter<2.5 μm.

**\***Adjusted for: age (continuous), beds per person (continuous), body mass index (continuous), physical activity (continuous).

1 Per one unit increase in natural log transformed pollution concentration.

**Supplementary Table 5.**  Effect modification by body mass index for the adjusted odds ratios in hypertensive status (borderline high or high blood pressure compared to normal) comparing continuous (natural log transformed) pollution concentrations and stove types among 147 Honduran women using either a traditional or *Justa* stove\*

|  |  |  |  |
| --- | --- | --- | --- |
| **24-hour average air pollution concentrations1** | **Body mass index category**  | **Odds ratio (95% CI)** | **p-value for interaction** |
| Personal PM2.5 (μg/m3) (n=104) | ≥25 BMI (n=54)<25 BMI (n=50) | 1.0 (0.6 to 1.8)1.1 (0.7 to 1.7) | 0.80 |
| Kitchen PM2.5 (μg/m3) (n=105) | ≥25 BMI (n=56)<25 BMI (n=49) | 1.5 (0.8 to 2.6)1.6 (1.0 to 2.6) | 0.77 |
| Personal BC (μg/m3) (n=105) | ≥25 BMI (n=55)<25 BMI (n=50) | 1.1 (0.6 to 1.9)1.0 (0.6 to 1.6) | 0.74 |
| Kitchen BC (μg/m3) (n=106) | ≥25 BMI (n=56)<25 BMI (n=50) | 1.7 (1.0 to 3.0)1.7 (1.0 to 2.7) | 0.92 |
| **Stove type (Traditional vs. *Justa*)**  | ≥25 BMI (n=73)<25 BMI (n=74) | 1.2 (0.7 to 1.9)1.4 (1.0 to 2.1) | 0.32 |

BC=black carbon; CI=confidence interval; PM=particulate matter<2.5 μm.

**\***Adjusted for: age (continuous), beds per person (continuous), body mass index (continuous), physical activity (continuous).

1 Per one unit increase in natural log transformed pollution concentration.

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