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*Supplementary Materials*

# Personal Exposure to Fine Particulate Air Pollution among Brick Workers in Nepal

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**Table S1.** Associations between job and housing characteristics and mean personal breathing zone temperature among workers[a] at a brick kiln in Bhaktapur, Nepal, March 2023.

| Characteristic | IQR | Temperature, °C | | |
|---|---|---|---|---|
| | | GM[b] | 95% CI[b] | p-value[b] |
| Job category | | | | |
| Administration | | 23.56 | 20.88, 26.59 | |
| Firemen | | 25.84 | 23.27, 28.69 | |
| Green brick hand molder | | 23.80 | 22.10, 25.63 | |
| Green brick machine molder | | 22.23 | 20.33, 24.30 | |
| Top loader | | 31.90 | 28.52, 35.68 | <0.001[c] |
| Internal house area, $m^2$ | 5.70 | 0.94[d] | 0.88, 1.01[d] | 0.08 |
| Internal house volume, $m^3$ | 12.43 | 0.95[d] | 0.90, 1.01[d] | 0.11 |
| How long lived in house, months | 20.00 | 0.99[d] | 0.97, 1.01[d] | 0.46 |
| Firemen home | | | | |
| No | | 24.60 | 23.19, 26.10 | |
| Yes | | 25.44 | 22.49, 28.78 | 0.62 |
| Where live during summer monsoon months when brick kilns are shut down | | | | |
| Same house | | 24.63 | 22.02, 27.55 | |
| Different house in the Kathmandu Valley | | 23.76 | 21.24, 26.57 | |
| Different house outside the Kathmandu Valley | | 25.25 | 23.48, 27.16 | 0.65 |
| How many people live in house | | | | |
| 1-2 | | 26.91 | 24.30, 29.79 | |
| 3-4 | | 22.98 | 21.09, 25.03 | |
| 5-11 | | 25.12 | 23.17, 27.23 | 0.06 |
| How many adults live in house | 2.00 | 0.97[d] | 0.90, 1.05[d] | 0.45 |
| How many children under 18 years of age live in house | | | | |
| 0 | | 25.86 | 23.53, 28.42 | |
| 1-5 | | 24.27 | 22.78, 25.87 | 0.27 |
| How many children under six years of age live in house | | | | |
| 0-1 | | 24.62 | 23.28, 26.05 | |
| 2 | | 25.96 | 22.01, 30.62 | 0.54 |
| Occupant density, residents/100 $m^2$ | 26.34 | 1.01[d] | 0.95, 1.07[d] | 0.83 |
| Heating source in the home | | | | |

| Characteristic | IQR | Temperature, °C | | |
|---|---|---|---|---|
| | | GM[b] | 95% CI[b] | p-value[b] |
| No | | 24.99 | 23.54, 26.53 | |
| Yes | | 23.89 | 21.26, 26.84 | 0.49 |
| How often is the heating source in the home used | | | | |
| Never | | 24.99 | 23.53, 26.55 | |
| Less than once per day | | 24.06 | 20.37, 28.43 | |
| Once per day or more | | 23.72 | 20.07, 28.02 | 0.79 |
| Any smokers living in the home | | | | |
| No | | 24.94 | 23.09, 26.95 | |
| Yes | | 24.59 | 22.83, 26.48 | 0.79 |
| How many smokers living in the home | 1.00 | 0.98[d] | 0.92, 1.04[d] | 0.48 |
| How many smokers living in the home regularly smoke inside the home | | | | |
| 0-1 | | 24.92 | 23.55, 26.36 | |
| 2-3 | | 23.44 | 19.88, 27.65 | 0.48 |

Abbreviations: CI, confidence interval; GM, geometric mean; GMR, geometric mean ratio; IQR, interquartile range.

[a] Two samples were missing because one of the 50 workers enrolled in the study declined to participate in the personal breathing zone air sampling and a MicroPEM malfunctioned for another worker, so we could not obtain personal breathing zone information for that worker.

[b] Estimated using simple (i.e., unadjusted) linear regression models of the natural logarithm transformed values.

[c] After using the Tukey-Kramer method to adjust for multiple comparisons, tests of pairwise differences among job categories had the following p-values: Administration vs. Firemen: 0.77, Administration vs. Green brick hand molder: >0.99, Administration vs. Green brick machine molder: 0.93, Administration vs. Top loader: 0.005, Firemen vs. Green brick hand molder: 0.70, Firemen vs. Green brick machine molder: 0.20, Firemen vs. Top loader: 0.06, Green brick hand molder vs. Green brick machine molder: 0.76, Green brick hand molder vs. Top loader: <0.001, Green brick machine molder vs. Top loader: <0.001.

[d] GMR (i.e., exponentiated regression slope coefficient) and 95% CI for an IQR increase in the job or housing characteristic; please note GMR - 1 = percent change in GM for an IQR increase in the job or housing characteristic; estimated using simple (i.e., unadjusted) linear regression models of the natural logarithm transformed values.

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**Table S2.** Associations between job and housing characteristics and mean personal breathing zone relative humidity among workers[a] at a brick kiln in Bhaktapur, Nepal, March 2023.

| Characteristic | IQR | Relative Humidity, % | | |
|---|---|---|---|---|
| | | AM[b] | 95% CI[b] | p-value[b] |
| Job category | | | | |
| Administration | | 45.19 | 49.42, 53.65 | |
| Firemen | | 37.05 | 40.71, 44.37 | |
| Green brick hand molder | | 46.85 | 49.45, 52.04 | |
| Green brick machine molder | | 52.08 | 55.21, 58.33 | |
| Top loader | | 37.31 | 41.23, 45.15 | <0.001[c] |
| Internal house area, $m^2$ | 5.70 | 3.69[d] | 1.06, 6.33[d] | 0.007 |
| Internal house volume, $m^3$ | 12.43 | 2.83[d] | 0.53, 5.13[d] | 0.02 |
| How long lived in house, months | 20.00 | -0.14[d] | -0.99, 0.70[d] | 0.73 |
| Firemen home | | | | |
| No | | 47.38 | 49.54, 51.70 | |
| Yes | | 37.39 | 41.90, 46.40 | 0.003 |
| Where live during summer monsoon months when brick kilns are shut down | | | | |
| Same house | | 44.47 | 48.87, 53.27 | |
| Different house in the Kathmandu Valley | | 46.29 | 50.70, 55.10 | |
| Different house outside the Kathmandu Valley | | 43.83 | 46.69, 49.55 | 0.29 |
| How many people live in house | | | | |
| 1-2 | | 43.52 | 47.55, 51.57 | |
| 3-4 | | 48.14 | 51.52, 54.91 | |
| 5-11 | | 42.21 | 45.41, 48.61 | 0.04[e] |
| How many adults live in house | 2.00 | -1.93[d] | -4.95, 1.10[d] | 0.21 |
| How many children under 18 years of age live in house | | | | |
| 0 | | 43.50 | 47.31, 51.13 | |
| 1-5 | | 45.89 | 48.47, 51.04 | 0.62 |
| How many children under six years of age live in house | | | | |
| 0-1 | | 46.20 | 48.44, 50.68 | |
| 2 | | 38.70 | 45.27, 51.85 | 0.36 |
| Occupant density, residents/100 $m^2$ | 26.34 | -2.84[d] | -5.19, -0.50[d] | 0.02 |
| Heating source in the home | | | | |

| Characteristic | IQR | Relative Humidity, % AM[b] | 95% CI[b] | p-value[b] |
|---|---|---|---|---|
| No | | 45.39 | 47.79, 50.18 | |
| Yes | | 44.66 | 49.33, 54.00 | 0.56 |
| How often is the heating source in the home used | | | | |
| Never | | 45.37 | 47.79, 50.21 | |
| Less than once per day | | 41.54 | 48.21, 54.87 | |
| Once per day or more | | 43.78 | 50.45, 57.12 | 0.75 |
| Any smokers living in the home | | | | |
| No | | 46.03 | 49.10, 52.17 | |
| Yes | | 44.26 | 47.20, 50.14 | 0.37 |
| How many smokers living in the home | 1.00 | -0.46[d] | -2.83, 1.91[d] | 0.70 |
| How many smokers living in the home regularly smoke inside the home | | | | |
| 0-1 | | 45.63 | 47.89, 50.14 | |
| 2-3 | | 43.40 | 50.01, 56.62 | 0.54 |

Abbreviations: AM, arithmetic mean; CI, confidence interval; IQR, interquartile range.

[a] Two samples were missing because one of the 50 workers enrolled in the study declined to participate in the personal breathing zone air sampling and a MicroPEM malfunctioned for another worker, so we could not obtain personal breathing zone information for that worker.

[b] Estimated using simple (i.e., unadjusted) linear regression models of the original values.

[c] After using the Tukey-Kramer method to adjust for multiple comparisons, tests of pairwise differences among job categories had the following p-values: Administration vs. Firemen: 0.02, Administration vs. Green brick hand molder: >0.99, Administration vs. Green brick machine molder: 0.19, Administration vs. Top loader: 0.05, Firemen vs. Green brick hand molder: 0.003, Firemen vs. Green brick machine molder: <0.001, Firemen vs. Top loader: >0.99, Green brick hand molder vs. Green brick machine molder: 0.05, Green brick hand molder vs. Top loader: 0.008, Green brick machine molder vs. Top loader: <0.001.

[d] Change in AM (i.e., regression slope coefficient) and 95% CI for an IQR increase in the job or housing characteristic; estimated using simple (i.e., unadjusted) linear regression models of the original values.

[e] After using the Tukey-Kramer method to adjust for multiple comparisons, tests of pairwise differences among categories of how many people live in house had the following p-values: 1-2 vs. 3-4: 0.29, 1-2 vs. 5-11: 0.68, 3-4 vs. 5-11: 0.03.

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**Table S3.** Associations between housing characteristics and mean personal breathing zone temperature adjusted for job category among workers[a] at a brick kiln in Bhaktapur, Nepal, March 2023.

| Housing Characteristic | Temperature p-value[b] | Job Characteristic | Temperature p-value[b] |
|---|---|---|---|
| Internal house area, $m^2$ | 0.98 | Job category | 0.001 |
| Internal house volume, $m^3$ | 0.78 | Job category | 0.001 |
| How long lived in house, months | 0.86 | Job category | <0.001 |
| Firemen home | 0.93 | Job category | <0.001 |
| Where live during summer monsoon months when brick kilns are shut down | 0.92 | Job category | <0.001 |
| How many people live in house | 0.42 | Job category | 0.001 |
| How many adults live in house | 0.99 | Job category | <0.001 |
| How many children under 18 years of age live in house | 0.27 | Job category | <0.001 |
| How many children under six years of age live in house | 0.62 | Job category | <0.001 |
| Occupant density, residents/100 $m^2$ | 0.75 | Job category | <0.001 |
| Heating source in the home | 0.50 | Job category | <0.001 |
| How often is the heating source in the home used | 0.80 | Job category | <0.001 |
| Any smokers living in the home | 0.37 | Job category | <0.001 |
| How many smokers living in the home | 0.35 | Job category | <0.001 |
| How many smokers living in the home regularly smoke inside the home | 0.82 | Job category | <0.001 |

[a] Two samples were missing because one of the 50 workers enrolled in the study declined to participate in the personal breathing zone air sampling and a MicroPEM malfunctioned for another worker, so we could not obtain personal breathing zone information for that worker.

[b] Estimated using multivariable linear regression models of the natural logarithm transformed values adjusted for job category and the housing characteristic.

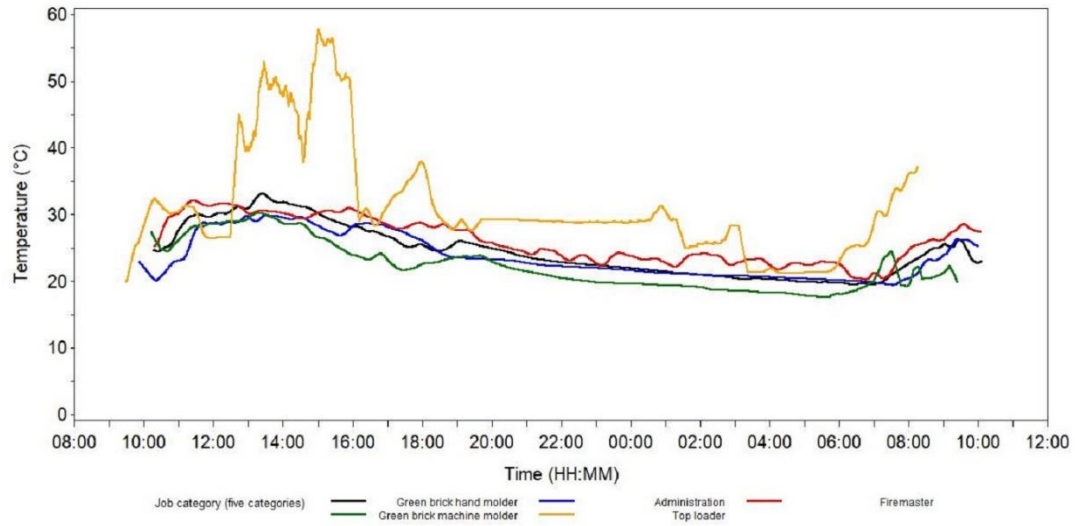
**Table S4.** Associations between housing characteristics and mean personal breathing zone relative humidity adjusted for job category among workers[a] at a brick kiln in Bhaktapur, Nepal, March 2023.

| | Relative Humidity | | Relative Humidity |
|---|---|---|---|
| **Housing Characteristic** | **p-value[b]** | **Job Characteristic** | **p-value[b]** |
| Internal house area, $m^2$ | 0.54 | Job category | <0.001 |
| Internal house volume, $m^3$ | 0.52 | Job category | <0.001 |
| How long lived in house, months | 0.27 | Job category | <0.001 |
| Firemen home | 0.44 | Job category | <0.001 |
| Where live during summer monsoon months when brick kilns are shut down | 0.57 | Job category | <0.001 |
| How many people live in house | 0.25 | Job category | <0.001 |
| How many adults live in house | 0.20 | Job category | <0.001 |
| How many children under 18 years of age live in house | 0.43 | Job category | <0.001 |
| How many children under six years of age live in house | 0.23 | Job category | <0.001 |
| Occupant density, residents/100 $m^2$ | 0.58 | Job category | <0.001 |
| Heating source in the home | 0.18 | Job category | <0.001 |
| How often is the heating source in the home used | 0.38 | Job category | <0.001 |
| Any smokers living in the home | 0.88 | Job category | <0.001 |
| How many smokers living in the home | 0.72 | Job category | <0.001 |
| How many smokers living in the home regularly smoke inside the home | 0.58 | Job category | <0.001 |

[a] Two samples were missing because one of the 50 workers enrolled in the study declined to participate in the personal breathing zone air sampling and a MicroPEM malfunctioned for another worker, so we could not obtain personal breathing zone information for that worker.

[b] Estimated using multivariable linear regression models of the original values adjusted for job category and the housing characteristic.

(a)




(b)

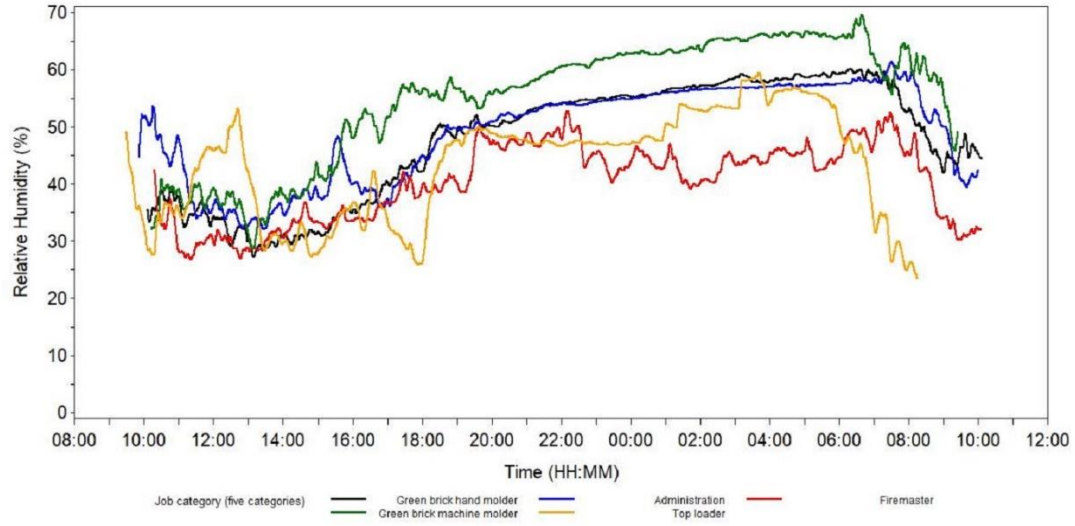



**Figure S1.** Line graphs of temporal trends in five-minute moving averages of arithmetic mean personal breathing zone temperature and relative humidity among workers[a] at a brick kiln in Bhaktapur, Nepal, March 2023: (a) temperature, (b) relative humidity. In each plot, results for each job category are shown with the following colors: Administration: blue, Firemen: red, Green brick hand molder: black, Green brick machine molder: green, Top loader: orange. [a] Two samples were missing because one of the 50 workers enrolled in the study declined to participate in the personal breathing zone air sampling and a MicroPEM malfunctioned for another worker, so we could not obtain personal breathing zone information for that worker.