**SUPPLEMENTAL INFORMATION**

**Determinants of phthalate exposure among a U.S.-based group of Latino workers.**

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**Supplemental Table S1.** Summary statistics for urinary phthalate metabolite concentrations by worker category for study participants (n=94).

Abbreviations: U, uncorrected metabolite concentrations, (µg/L); SG, Specific-gravity corrected metabolite concentrations, (µg/L); LOD, limit of detection; DF%, detection frequency percentage; P25,50,75, 25th, 50th, and 75th percentiles, respectively.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Phthalate Metabolite** |  | **Summary Statistics of Phthalate Metabolite Concentrations (µg/L)** | | | | | | | |
| **LOD**  **(µg/L)** | **Workers in**  **Facilities Management (n=48)** | | | **Workers in**  **Residential Facilities (n=27)** | | | **Workers in**  **Dining Services (n=19)** | |
| DF% | P50 (P25, P75) | DF% | | P50 (P25, P75) | DF% | | P50 (P25, P75) |
| MEP | 0.24 | 100 | U: 12.3 (5.28, 38.5)  SG: 13.1 (6.41, 37.8) | 100 | | U: 10.9 (6.07, 78.7)  SG: 24.9 (10.6, 100.3) | 100 | | U: 26.8 (5.26, 86.5)  SG: 35.9 (6.28, 102.1) |
| MBzP | 0.06 | 95.8 | U: 1.78 (0.86, 4.28)  SG:1.77 (1.24, 2.96) | 85.2 | | U: 1.16 (0.27, 1.66)  SG: 1.26 (0.55, 3.22) | 94.7 | | U: 0.86 (0.38, 1.91)  SG:0.88 (0.64, 1.61) |
| MBP | 0.25 | 97.9 | U: 5.81 (2.58, 12.6)  SG: 7.22 (3.24, 12.7) | 77.8 | | U: 2.42 (0.42, 4.95)  SG: 2.95 (2.07, 9.09) | 79.0 | | U: 1.62 (0.39, 2.97)  SG: 1.42 (0.75, 2.29) |
| MiBP | 0.54 | 85.4 | U: 3.34 (1.53, 6.93)  SG: 3.40 (1.60, 10.0) | 55.6 | | U: 0.75 (0.38, 2.80)  SG: 1.52 (0.74, 4.56) | 57.9 | | U: 0.78 (0.38, 2.18)  SG: 1.14 (0.72, 2.25) |
| MCPP | 0.19 | 52.1 | U: 0.29 (<LOD, 0.76)  SG: 0.33 (<LOD, 0.69) | 33.3 | | U: <LOD (<LOD, 0.32)  SG: <LOD (<LOD, 1.01) | 31.6 | | U: <LOD (<LOD, 0.39)  SG: <LOD (<LOD, 0.39) |
| MEHHP | 0.20 | 97.9 | U: 3.78 (2.16, 6.50)  SG: 3.69 (2.41, 6.65) | 100 | | U: 2.60 (0.87, 4.27)  SG: 2.98 (2.05, 6.89) | 100 | | U: 2.98 (1.43, 5.67)  SG: 2.74 (2.03, 4.22) |
| MECPP | 0.16 | 97.9 | U: 3.75 (1.98, 6.63)  SG: 3.89 (2.26, 6.56) | 96.3 | | U: 1.59 (0.58, 4.28)  SG: 3.02 (1.53, 7.00) | 94.7 | | U: 2.35 (0.77, 4.82)  SG: 2.87 (1.29, 4.32) |
| MEOHP | 0.09 | 95.8 | U: 1.85 (1.03, 3.74)  SG: 1.87 (1.26, 3.81) | 88.9 | | U: 1.29 (0.30, 2.21)  SG: 1.25 (0.75, 3.57) | 89.5 | | U: 1.23 (0.51, 2.61)  SG: 1.44 (0.64, 2.32) |
| MEHP | 0.29 | 4.2 | U: <LOD (<LOD, <LOD)  SG: <LOD (<LOD, <LOD) | 0 | | U: <LOD (<LOD, <LOD)  SG: <LOD (<LOD, <LOD) | 0 | | U: <LOD (<LOD, <LOD)  SG: <LOD (<LOD, <LOD) |
| ∑DEHP | -- | -- | U: 0.03 (0.02, 0.06)  SG: 0.03 (0.02, 0.06) | -- | | U: 0.02 (0.01, 0.04)  SG: 0.03 (0.02, 0.05) | -- | | U: 0.02 (0.01, 0.04)  SG: 0.02 (0.02, 0.03) |

**Supplemental Table S2.** Spearman correlations between continuous variables and phthalate metabolite concentrations (n=94).

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Phthalate metabolite** | **Age** | | **Total Annual Household Income** | | **Time in the U.S.** | | **BMI** | |
| *𝜌* | *p-value* | *𝜌* | *p-value* | *𝜌* | *p-value* | *𝜌* | *p-value* |
| **MEP** | -0.05 | 0.64 | 0.02 | 0.84 | -0.10 | 0.32 | 0.10 | 0.35 |
| **MBzP** | 0.07 | 0.53 | -0.01 | 0.95 | 0.06 | 0.55 | 0.23 | 0.02\* |
| **MBP** | 0.23 | 0.02\* | 0.04 | 0.71 | 0.12 | 0.26 | 0.14 | 0.19 |
| **MiBP** | 0.21 | 0.04\* | -0.01 | 0.96 | 0.05 | 0.63 | 0.07 | 0.50 |
| **DEHP** | 0.05 | 0.61 | -0.12 | 0.26 | 0.03 | 0.77 | 0.04 | 0.71 |

BMI: Body mass index; (\*) indicates p-value<0.05

Chart

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Values reported under the sample size for each response reflects p50,(p25, p75) concentrations.

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Values reported under the sample size for each response reflects p50,(p25, p75) concentrations.

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Values reported under the sample size for each response reflects p50,(p25, p75) concentrations.

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Values reported under the sample size for each response reflects p50,(p25, p75) concentrations.

Box and whisker chart

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Values reported under the sample size for each response reflects p50,(p25, p75) concentrations.

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Values reported under the sample size for each response reflects p50,(p25, p75) concentrations.

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Values reported under the sample size for each response reflects p50,(p25, p75) concentrations.

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Values reported under the sample size for each response reflects p50,(p25, p75) concentrations.

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Values reported under the sample size for each response reflects p50,(p25, p75) concentrations.

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Values reported under the sample size for each response reflects p50,(p25, p75) concentrations.

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Values reported under the sample size for each response reflects p50,(p25, p75) concentrations.

**Supplemental Table S3.** Results from multiple testing using the Benjamini-Hochberg procedure.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Phthalate Metabolite** | **Predictor considered** | **MLR p-value** | **Benjamini-Hochberg significance** | **Benjamini-Hochberg p-value** |
| MEP | scented dryer sheets | 0.025 | Significant | 0.145 |
|  | furniture polish | 0.029 | Significant | 0.145 |
|  | low fat milk consumption | 0.078 | Significant | 0.220 |
|  | pasta/rice/noodles | 0.1 | Significant | 0.220 |
|  | perfume | 0.11 | Significant | 0.220 |
|  | antibacterial soap | 0.153 | Not significant | 0.255 |
|  | food insecurity | 0.199 | Not significant | 0.284 |
|  | whiteboard cleaner | 0.327 | Not significant | 0.409 |
|  | dining services worker | 0.612 | Not significant | 0.680 |
|  | residential facilities worker | 0.717 | Not significant | 0.717 |
|  |  |  |  |  |
| MBzP | pasta/rice/noodles | 0.005 | Significant | 0.040 |
|  | bleach | 0.008 | Significant | 0.040 |
|  | fresh vegetable consumption | 0.135 | Not significant | 0.270 |
|  | makeup | 0.102 | Not significant | 0.270 |
|  | residential facilities worker | 0.109 | Not significant | 0.270 |
|  | foods stored in plastic | 0.166 | Not significant | 0.277 |
|  | degreaser use at work | 0.248 | Not significant | 0.354 |
|  | soda consumption | 0.374 | Not significant | 0.374 |
|  | dining services worker | 0.335 | Not significant | 0.374 |
|  | glass cleaner | 0.339 | Not significant | 0.374 |
|  |  |  |  |  |
| MBP | scented carpet cleaner | 0.116 | Not significant | 0.348 |
|  | residential facilities worker | 0.07 | Not significant | 0.348 |
|  | dining services worker | 0.094 | Not significant | 0.348 |
|  | foods stored in plastic | 0.16 | Not significant | 0.360 |
|  | makeup | 0.247 | Not significant | 0.432 |
|  | glass cleaner use at work | 0.288 | Not significant | 0.432 |
|  | cleaner (not bleach) | 0.358 | Not significant | 0.460 |
|  | renovations in the last 6 months | 0.557 | Not significant | 0.627 |
|  | use of dust mask at work | 0.723 | Not significant | 0.723 |
|  |  |  |  |  |
| MiBP | residential facilities worker | 0.077 | Not significant | 0.308 |
|  | degreaser use at work | 0.075 | Not significant | 0.308 |
|  | sugar sweetened beverages | 0.354 | Not significant | 0.520 |
|  | makeup | 0.39 | Not significant | 0.520 |
|  | dining services worker | 0.283 | Not significant | 0.520 |
|  | glass cleaner use at work | 0.256 | Not significant | 0.520 |
|  | soda consumption | 0.593 | Not significant | 0.678 |
|  | use of dust mask at work | 0.716 | Not significant | 0.716 |
|  |  |  |  |  |
| DEHP | processed meat consumption | 0.098 | Significant | 0.196 |
|  | use of hairstyling products | 0.084 | Significant | 0.196 |
|  | scented candles | 0.085 | Significant | 0.196 |
|  | degreaser use at work | 0.033 | Significant | 0.196 |
|  | glass cleaner use at work | 0.176 | Not significant | 0.282 |
|  | sugar sweetened beverages | 0.728 | Not significant | 0.832 |
|  | residential facilities worker | 0.703 | Not significant | 0.832 |
|  | dining services worker | 0.936 | Not significant | 0.936 |
| Abbreviations: MLR, Multivariable linear regression model. | | | | |

# Supplemental Table S4. Comparison of median concentrations (µg/L) with phthalate concentrations from studies in other countries.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Present study**  **(Sampling period: 2017-2018)** | | | | | | **Canadian Health Measures Survey (Sampling period: 2009-2011; Country: Canada)**  **(Haines et al., 2017)** | | **German Environmental Specimen Bank (Sampling period: 2014-2015; Country: Germany)**  **(Koch et al., 2017)** | | **EDEN and PALAGIE Cohorts (Sampling period: 2002-2006; Country: France)**  **(Philippat et al., 2012)** | |
|  | **Adults aged 19-65 years**  **(n=94)** | | **Males 19-65 years**  **(n=9)** | | **Females 19-65 years**  **(n=85)** | | **Canadians aged 3-79 years**  **(n=2,498-2,561; varies based on metabolite)** | | **Male and female German university students aged 20-29 years (n=60)** | | **Pregnant women in France**  **(n=287)** | |
| **Phthalate metabolite** | **DF%** | **Phthalate metabolite concentration, µg/L**  P50 (P25,75) | **DF%** | **Phthalate metabolite concentration, µg/L**  P50 (P25,75) | **DF%** | **Phthalate metabolite concentration, µg/L**  P50 (P25,75) | **DF%** | **Phthalate metabolite concentration, µg/L**  P50 (P25,75) | **DF%** | **Phthalate metabolite concentration, µg/L**  P50 | **DF%** | **Phthalate metabolite concentration, µg/L**  P50 |
| **MBP** | 88 | U: 3.17 (1.27, 9.54)  SG: 4.35 (1.86, 9.41) | 100 | U: 7.22 (3.13, 22.2)  SG: 6.36 (4.70, 17.2) | 87 | U: 2.97 (1.20, 9.01)  SG: 3.68 (1.85, 9.09) | 100 | U: 20 (11, 36) | -- | U: 8.0 | 100 | U: 48.1 |
| **MBzP** | 93 | U: 1.33 (0.53, 3.01)  SG: 1.51 (0.78, 2.66) | 100 | U: 1.77 (1.38, 3.30)  SG: 2.33 (0.88, 3.22) | 91 | U: 1.29 (0.53, 2.81)  SG: 1.49 (0.76, 2.65) | 100 | U: 7.1 (3.4, 16) | -- | U: 1.2 | 100 | U: 17.7 |
| **MCPP** | 43 | U: <LOD (<LOD, 0.48)  SG: <LOD (<LOD, 0.61) | 67 | U: 0.44 (<LOD, 0.59)  SG: 0.38 (<LOD, 0.60) | 40 | U: <LOD (<LOD , 0.45)  SG: <LOD (<LOD, 0.66) | 99.9 | U: 2.0 (1.0, 3.8) | -- | U: 0.3 | 98 | U: 2.2 |
| **MECPP** | 97 | U: 3.06 (1.09, 5.77)  SG: 3.24 (1.88, 5.71) | 100 | U: 3.03 (2.11, 3.46)  SG: 2.87 (2.67, 3.02) | 97 | U: 3.12 (1.06, 6.11)  SG: 3.47 (1.88, 6.49) | -- | -- | -- | U: 3.8 | 100 | U: 43.8 |
| **MEHHP** | 99 | U: 2.98 (1.43, 5.67)  SG: 3.44 (2.24, 6.39) | 100 | U: 2.68 (1.87, 3.27)  SG: 2.37 (1.94, 2.74) | 99 | U: 3.15 (1.40, 6.21)  SG: 3.61 (2.27, 6.44) | 99.9 | U: 23 (11, 47) | -- | U: 4.2 | 100 | U: 32.3 |
| **MEHP** | 2 | U: <LOD (<LOD, <LOD)  SG: <LOD (<LOD, <LOD) | 0 | U: <LOD (<LOD, <LOD)  SG: <LOD (<LOD, <LOD) | 2 | U: <LOD (<LOD, <LOD)  SG: <LOD (<LOD, <LOD) | 99.4 | U: 1.9 (0.97, 3.4) | -- | U: 1.1 | 92 | U: 7.1 |
| **MEOHP** | 93 | U: 1.49 (0.60, 3.21)  SG: 1.58 (0.88, 3.57) | 100 | U: 1.41 (0.88, 1.57)  SG: 1.35 (0.94, 1.44) | 92 | U: 1.52 (0.57, 3.45)  SG: 1.73 (0.88, 3.74) | 100 | U: 7.4 (4.1, 14) | -- | U: 3.2 | 99.7 | U: 25.0 |
| **MEP** | 100 | U: 12.8 (5.85, 59.9)  SG: 18.3 (7.31, 61.2) | 100 | U: 12.6 (8.70, 35.0)  SG: 16.9 (7.31, 35.9) | 100 | U: 13.0 (5.31, 66.3)  SG: 19.2 (7.42, 67.9) | 100 | U: 42 (18, 100) | -- | U:13.5 | 100 | U: 110.22 |
| **MiBP** | 71 | U: 1.73 (<LOD, 4.79)  SG: 2.30 (<LOD, 4.77) | 89 | U: 2.30 (2.00, 5.62)  SG: 2.23 (1.68, 3.34) | 69 | U: 1.56 (<LOD, 4.62)  SG: 2.32 (<LOD, 4.77) | -- | -- | -- | U: 9.8 | 100 | U: 45.9 |

**Supplemental Table S4.** Comparison of median concentrations (µg/L) with phthalate concentrations from studies in other countries. (continued).

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Present study**  **(Sampling period: 2017-2018)** | | | | | | **(Sampling period: 2012-2014; Country: Korea)**  **(Choi, 2017)** | | | **(Sampling period: 2011; Country: Israel)**  **(Berman et al., 2013)** | | | **Generation R (Sampling period: 2004-2005)**  **Country: Netherlands**  **(Philips et al., 2018)** | |
|  | **Adults aged 19-65 years**  **(n=94)** | | **Males 19-65 years**  **(n=9)** | | **Females 19-65 years**  **(n=85)** | | **Male and female adults aged ≥19 years**  **(n=6,252-6,406; varied based on metabolite)** | | | **Adults aged 20-74 years**  **(n=248)** | | | **Pregnant women in Rotterdam**  **(n=877)** | |
| **Phthalate metabolite** | **DF%** | **Phthalate metabolite concentration, µg/L**  P50 (P25,75) | **DF%** | **Phthalate metabolite concentration, µg/L**  P50 (P25,75) | **DF%** | **Phthalate metabolite concentration, µg/L**  P50 (P25,75) | | **DF%** | **Phthalate metabolite concentration, µg/L**  P50 (P25,75) | | **DF%** | **Phthalate metabolite concentration, µg/L**  P50 | **DF%** | **Phthalate metabolite concentration, µg/L**  P50 (P25,75) |
| **MBP** | 88 | U: 3.17 (1.27, 9.54)  SG: 4.35 (1.86, 9.41) | 100 | U: 7.22 (3.13, 22.2)  SG: 6.36 (4.70, 17.2) | 87 | U: 2.97 (1.20, 9.01)  SG: 3.68 (1.85, 9.09) | | 99.7 | U: 24.9 (13.1, 44.2) | | 99 | U: 27.9 | 99.0 | U: 15.31 (6.73, 30.26) |
| **MBzP** | 93 | U: 1.33 (0.53, 3.01)  SG: 1.51 (0.78, 2.66) | 100 | U: 1.77 (1.38, 3.30)  SG: 2.33 (0.88, 3.22) | 91 | U: 1.29 (0.53, 2.81)  SG: 1.49 (0.76, 2.65) | | 97.7 | U: 2.80 (1.32, 5.84) | | 92 | U: 4.3 | 91.3 | U: 6.19 (2.85, 11.92) |
| **MCPP** | 43 | U: <LOD (<LOD, 0.48)  SG: <LOD (<LOD, 0.61) | 67 | U: 0.44 (<LOD, 0.59)  SG: 0.38 (<LOD, 0.60) | 40 | U: <LOD (<LOD , 0.45)  SG: <LOD (<LOD, 0.66) | | -- | -- | | -- | -- | 100 | U: 1.41 (0.75, 2.70) |
| **MECPP** | 97 | U: 3.06 (1.09, 5.77)  SG: 3.24 (1.88, 5.71) | 100 | U: 3.03 (2.11, 3.46)  SG: 2.87 (2.67, 3.02) | 97 | U: 3.12 (1.06, 6.11)  SG: 3.47 (1.88, 6.49) | | 100 | U: 20.9 (12.2, 34.4) | | 100 | U: 34.2 | 99.9 | U: 15.86 (8.00, 31.88) |
| **MEHHP** | 99 | U: 2.98 (1.43, 5.67)  SG: 3.44 (2.24, 6.39) | 100 | U: 2.68 (1.87, 3.27)  SG: 2.37 (1.94, 2.74) | 99 | U: 3.15 (1.40, 6.21)  SG: 3.61 (2.27, 6.44) | | 99.8 | U: 18.7 (10.3, 31.7) | | 100 | U: 30.4 | 99.8 | U: 11.40 (5.67, 23.22) |
| **MEHP** | 2 | U: <LOD (<LOD, <LOD)  SG: <LOD (<LOD, <LOD) | 0 | U: <LOD (<LOD, <LOD)  SG: <LOD (<LOD, <LOD) | 2 | U: <LOD (<LOD, <LOD)  SG: <LOD (<LOD, <LOD) | | -- | -- | | 100 | U: 11.2 | 76.4 | U: 0.33 (0.16, 0.63) |
| **MEOHP** | 93 | U: 1.49 (0.60, 3.21)  SG: 1.58 (0.88, 3.57) | 100 | U: 1.41 (0.88, 1.57)  SG: 1.35 (0.94, 1.44) | 92 | U: 1.52 (0.57, 3.45)  SG: 1.73 (0.88, 3.74) | | 99.8 | U: 13.0 (7.27, 22.1) | | 100 | U: 17.1 | 100 | U: 7.63 (3.43, 15.54) |
| **MEP** | 100 | U: 12.8 (5.85, 59.9)  SG: 18.3 (7.31, 61.2) | 100 | U: 12.6 (8.70, 35.0)  SG: 16.9 (7.31, 35.9) | 100 | U: 13.0 (5.31, 66.3)  SG: 19.2 (7.42, 67.9) | | -- | -- | | -- | -- | 99.9 | U: 130.99 (39.68, 438.52) |
| **MiBP** | 71 | U: 1.73 (<LOD, 4.79)  SG: 2.30 (<LOD, 4.77) | 89 | U: 2.30 (2.00, 5.62)  SG: 2.23 (1.68, 3.34) | 69 | U: 1.56 (<LOD, 4.62)  SG: 2.32 (<LOD, 4.77) | | -- | -- | | 100 | U: 37.6 | 99.8 | U: 20.28 (9.14, 42.51) |

Abbreviations: U, uncorrected metabolite concentrations, (µg/L); SG, Specific-gravity corrected metabolite concentrations, (µg/L); LOD, limit of detection; DF%, detection frequency percentage; P25,50,75, 25th, 50th, and 75th percentiles, respectively; --, values not reported.