**Supporting Information**

# Lead Distribution in Urban Soil in a Medium-Sized City: Household-Scale Analysis

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## 1. Publically available data used to create curated dataset

| Table S1. Publicly Available Data Used to Create Curated Data Set for Estimating Soil Pb Risks | | | |
|---|---|---|---|
| **Information Category** | **Variable Description** | **Values** | **Source** |
| House Characteristics | House age | Continuous (decades) | Guilford County Tax Department [1] |
| | Property value | Continuous ($100,000s) | Guilford County Tax Department[1] |
| | Tax value | Continuous ($100,000s) | Guilford County Tax Department[1] |
| Census Block Characteristics | Race/ethnicity | % Black, % Hispanic/Latino, % White | Census 2010, U.S. [2] |
| | Median household income (adjusted for 2018) | Continuous ($100,000s) | Census 2010, U.S.[2] |
| Land use/land cover | Proximity to major roadways | Continuous (km) | TIGER, 2015[3] |
| | Population density | Continuous (people/km$^2$) | Census 2010, U.S.[2] |
| | Land cover | Categorical (e.g., developed, forest, grassland) | LANDFIRE 2010 [4] |
| | Urban/rural status | Categorical | TIGER, 2017[5] |
| Soil characteristics | Soil symbol | Categorical | Web Soil Survey, 2003 [6] |
| | Soil organic matter content | Continuous (kg/m$^2$) | S.S.U.R.G.O. Soil Organic Matter [7] |
| | % silt | Continuous | S.S.U.R.G.O. Percent Soil Silt [8] |
| | % sand | Continuous | S.S.U.R.G.O. Percent Soil Sand [9] |
| | % clay | Continuous | S.S.U.R.G.O. Percent Soil Clay[10] |
| | pH | Continuous | S.S.U.R.G.O. Soil pH [11] |

## 2. Conditional probability distribution for % Black.

| Table S2. Conditional Probability Distribution for % Black | | | | | |
|---|---|---|---|---|---|
| Soil Pb > 100 ppm | House Value | House Age | <=0.355 (1/3) | <=0.727 (2/3) | >0.727 (3/3) |
| 0 | <=1.292 (1/3) | <=4.2 (1/3) | 3.0821 | 17.2668 | 79.6510 |
| | | <=7.9 (2/3) | 19.1297 | 14.9119 | 65.9584 |
| | | >7.9 (3/3) | 32.1180 | 22.3717 | 45.5103 |
| | <=2.859 (2/3) | <=4.2 (1/3) | 99.9681 | 0.0016 | 0.0302 |
| | | <=7.9 (2/3) | 95.1616 | 0.0012 | 4.8372 |
| | | >7.9 (3/3) | 70.5748 | 22.8479 | 6.5773 |
| | >2.859 (3/3) | <=4.2 (1/3) | 99.9630 | 0.0185 | 0.0185 |
| | | <=7.9 (2/3) | 32.2802 | 33.3743 | 34.3455 |
| | | >7.9 (3/3) | 99.9918 | 0.0041 | 0.0041 |
| 1 | <=1.292 (1/3) | <=4.2 (1/3) | 0.8982 | 14.3464 | 84.7554 |
| | | <=7.9 (2/3) | 15.1104 | 12.2234 | 72.6662 |
| | | >7.9 (3/3) | 8.9816 | 15.7471 | 75.2713 |
| | <=2.859 (2/3) | <=4.2 (1/3) | 33.3333 | 33.3333 | 33.3333 |
| | | <=7.9 (2/3) | 58.9596 | 0.0095 | 41.0310 |
| | | >7.9 (3/3) | 81.2367 | 9.2646 | 9.4987 |
| | >2.859 (3/3) | <=4.2 (1/3) | 33.3332 | 33.3332 | 33.3336 |
| | | <=7.9 (2/3) | 0.2107 | 0.2114 | 99.5779 |
| | | >7.9 (3/3) | 99.9641 | 0.0160 | 0.0199 |

## 3. Conditional probability distribution for % Soil Clay

| Table S3. Conditional Probability Distribution for % Soil Clay | | | |
|---|---|---|---|
| Soil Pb > 100 ppm | <=26.14 (1/3) | <=33.125 (2/3) | >33.125 (3/3) |
| 0 | 12.3010 | 84.4437 | 3.2553 |
| 1 | 0.9530 | 99.0453 | 0.0017 |

## 4. Conditional probability distribution for distance to major roads

| Table S4. Conditional Probability Distribution for Distance to Major Road | | | | | |
|---|---|---|---|---|---|
| Soil Pb > 100 ppm | % Soil Clay | % Black | <=500 (1/3) | <=1000 (2/3) | >1000 (3/3) |
| 0 | <=26.14 (1/3) | <=0.355 (1/3) | 20.8351 | 42.7072 | 36.4577 |
| | | <=0.727 (2/3) | 0.4203 | 99.2242 | 0.3555 |
| | | >0.727 (3/3) | 31.3593 | 68.6379 | 0.0028 |
| | <=33.125 (2/3) | <=0.355 (1/3) | 85.8547 | 4.7081 | 9.4372 |
| | | <=0.727 (2/3) | 67.5059 | 26.8051 | 5.6890 |
| | | >0.727 (3/3) | 51.7586 | 32.7260 | 15.5154 |
| | >33.125 (3/3) | <=0.355 (1/3) | 0.0046 | 0.0046 | 99.9907 |
| | | <=0.727 (2/3) | 1.3442 | 97.3116 | 1.3442 |
| | | >0.727 (3/3) | 0.0810 | 99.8486 | 0.0703 |
| 1 | <=26.14 (1/3) | <=0.355 (1/3) | 0.0580 | 99.8957 | 0.0462 |
| | | <=0.727 (2/3) | 8.1538 | 84.7843 | 7.0619 |
| | | >0.727 (3/3) | 0.0605 | 99.9055 | 0.0339 |
| | <=33.125 (2/3) | <=0.355 (1/3) | 97.6485 | 0.7468 | 1.6046 |
| | | <=0.727 (2/3) | 54.4774 | 40.7198 | 4.8028 |
| | | >0.727 (3/3) | 52.4837 | 39.8081 | 7.7083 |
| | >33.125 (3/3) | <=0.355 (1/3) | 38.8742 | 30.5629 | 30.5629 |
| | | <=0.727 (2/3) | 33.3568 | 33.3529 | 33.2902 |
| | | >0.727 (3/3) | 32.7118 | 35.2556 | 32.0326 |

## 5. Conditional probability distribution for house age

| Table S5. Conditional Probability Distribution for House Age | | | | |
|---|---|---|---|---|
| Soil Pb > 100 ppm | % Soil Clay | <=4.2 (1/3) | <=7.9 (2/3) | >7.9 (3/3) |
| 0 | <=26.14 (1/3) | 84.9419 | 14.4348 | 0.6234 |
| | <=33.125 (2/3) | 10.7233 | 62.6876 | 26.5891 |
| | >33.125 (3/3) | 35.0795 | 64.9075 | 0.0130 |
| 1 | <=26.14 (1/3) | 0.0585 | 57.7211 | 42.2203 |
| | <=33.125 (2/3) | 11.3061 | 49.9981 | 38.6958 |
| | >33.125 (3/3) | 31.9229 | 33.1380 | 34.9390 |

## 6. Conditional probability distribution for house value

| Table S6. Conditional Probability Distribution for House Value | | | | | |
|---|---|---|---|---|---|
| Soil Pb > 100 ppm | House Age | % Soil Clay | <=1.292 (1/3) | <=2.859 (2/3) | >2.859 (3/3) |
| 0 | <=4.2 (1/3) | <=26.14 (1/3) | 30.8065 | 69.1921 | 0.0013 |
| | | <=33.125 (2/3) | 87.8019 | 12.1959 | 0.0022 |
| | | >33.125 (3/3) | 0.0134 | 33.3330 | 66.6536 |
| | <=7.9 (2/3) | <=26.14 (1/3) | 99.9198 | 0.0722 | 0.0080 |
| | | <=33.125 (2/3) | 80.7578 | 19.2419 | 0.0003 |
| | | >33.125 (3/3) | 21.9710 | 78.0223 | 0.0067 |
| | >7.9 (3/3) | <=26.14 (1/3) | 99.5870 | 0.2053 | 0.2077 |
| | | <=33.125 (2/3) | 63.8219 | 20.7697 | 15.4085 |
| | | >33.125 (3/3) | 33.3338 | 33.3331 | 33.3331 |
| 1 | <=4.2 (1/3) | <=26.14 (1/3) | 33.3333 | 33.3333 | 33.3333 |
| | | <=33.125 (2/3) | 99.9967 | 0.0017 | 0.0017 |
| | | >33.125 (3/3) | 33.3333 | 33.3333 | 33.3333 |
| | <=7.9 (2/3) | <=26.14 (1/3) | 86.2229 | 0.1853 | 13.5918 |
| | | <=33.125 (2/3) | 95.8487 | 4.1245 | 0.0268 |
| | | >33.125 (3/3) | 35.6089 | 32.1506 | 32.2405 |
| | >7.9 (3/3) | <=26.14 (1/3) | 99.9075 | 0.0463 | 0.0462 |
| | | <=33.125 (2/3) | 94.1360 | 2.8316 | 3.0324 |
| | | >33.125 (3/3) | 31.4267 | 36.4627 | 32.1106 |

## 7. Conditional probability distribution for median household income.

| Table S7. Conditional Probability Distribution for Median Household Income | | | | | | |
|---|---|---|---|---|---|---|
| Soil Pb > 100 ppm | House Value | Distance to Major Road | % Black | <=0.255 (1/3) | <=0.47 (2/3) | >0.47 (3/3) |
| 0 | <=1.292 (1/3) | <=500 (1/3) | <=0.355 (1/3) | 87.5412 | 6.4845 | 5.9743 |
| | | | <=0.727 (2/3) | 69.0671 | 5.9874 | 24.9455 |
| | | | >0.727 (3/3) | 55.0038 | 44.9960 | 0.0002 |
| | | <=1000 (2/3) | <=0.355 (1/3) | 0.0616 | 99.8768 | 0.0616 |
| | | | <=0.727 (2/3) | 0.0013 | 99.9973 | 0.0013 |
| | | | >0.727 (3/3) | 46.8164 | 53.1833 | 0.0003 |
| | | >1000 (3/3) | <=0.355 (1/3) | 0.0016 | 46.8451 | 53.1533 |
| | | | <=0.727 (2/3) | 0.0064 | 99.9872 | 0.0064 |
| | | | >0.727 (3/3) | 24.2970 | 75.7022 | 0.0007 |
| | <=2.859 (2/3) | <=500 (1/3) | <=0.355 (1/3) | 1.2226 | 58.5122 | 40.2652 |
| | | | <=0.727 (2/3) | 0.0044 | 99.9912 | 0.0044 |
| | | | >0.727 (3/3) | 0.0281 | 99.9438 | 0.0281 |

| Table S7. Conditional Probability Distribution for Median Household Income | | | | | | |
|---|---|---|---|---|---|---|
| Soil Pb > 100 ppm | House Value | Distance to Major Road | % Black | <=0.255 (1/3) | <=0.47 (2/3) | >0.47 (3/3) |
| | | <=1000 (2/3) | <=0.355 (1/3) | 6.7805 | 0.0010 | 93.2185 |
| | | | <=0.727 (2/3) | 32.6967 | 34.6066 | 32.6967 |
| | | | >0.727 (3/3) | 99.9862 | 0.0073 | 0.0066 |
| | | >1000 (3/3) | <=0.355 (1/3) | 0.0010 | 0.0010 | 99.9981 |
| | | | <=0.727 (2/3) | 33.3333 | 33.3333 | 33.3333 |
| | | | >0.727 (3/3) | 33.3333 | 33.3333 | 33.3333 |
| | >2.859 (3/3) | <=500 (1/3) | <=0.355 (1/3) | 0.0014 | 61.5918 | 38.4069 |
| | | | <=0.727 (2/3) | 33.3333 | 33.3333 | 33.3333 |
| | | | >0.727 (3/3) | 33.2172 | 33.5655 | 33.2172 |
| | | <=1000 (2/3) | <=0.355 (1/3) | 33.3333 | 33.3333 | 33.3333 |
| | | | <=0.727 (2/3) | 32.2405 | 35.5190 | 32.2405 |
| | | | >0.727 (3/3) | 33.1919 | 35.4458 | 31.3622 |
| | | >1000 (3/3) | <=0.355 (1/3) | 0.0062 | 0.0062 | 99.9877 |
| | | | <=0.727 (2/3) | 33.3333 | 33.3333 | 33.3333 |
| | | | >0.727 (3/3) | 33.3333 | 33.3333 | 33.3333 |
| 1 | <=1.292 (1/3) | <=500 (1/3) | <=0.355 (1/3) | 61.2146 | 21.0772 | 17.7082 |
| | | | <=0.727 (2/3) | 38.2179 | 33.6993 | 28.0829 |
| | | | >0.727 (3/3) | 39.5146 | 60.4852 | 0.0002 |
| | | <=1000 (2/3) | <=0.355 (1/3) | 0.0154 | 99.9692 | 0.0154 |
| | | | <=0.727 (2/3) | 18.5190 | 81.4798 | 0.0011 |
| | | | >0.727 (3/3) | 69.2191 | 30.7807 | 0.0002 |
| | | >1000 (3/3) | <=0.355 (1/3) | 0.0287 | 99.9426 | 0.0287 |
| | | | <=0.727 (2/3) | 0.0097 | 99.9806 | 0.0097 |
| | | | >0.727 (3/3) | 0.0013 | 99.9976 | 0.0012 |
| | <=2.859 (2/3) | <=500 (1/3) | <=0.355 (1/3) | 15.1664 | 25.2752 | 59.5585 |
| | | | <=0.727 (2/3) | 0.0616 | 99.8768 | 0.0616 |
| | | | >0.727 (3/3) | 0.0079 | 99.9843 | 0.0077 |
| | | <=1000 (2/3) | <=0.355 (1/3) | 99.8768 | 0.0616 | 0.0616 |
| | | | <=0.727 (2/3) | 33.0162 | 33.9675 | 33.0162 |
| | | | >0.727 (3/3) | 99.8862 | 0.0690 | 0.0448 |
| | | >1000 (3/3) | <=0.355 (1/3) | 33.3333 | 33.3333 | 33.3333 |
| | | | <=0.727 (2/3) | 32.3804 | 35.2391 | 32.3804 |
| | | | >0.727 (3/3) | 33.3333 | 33.3333 | 33.3333 |
| | >2.859 (3/3) | <=500 (1/3) | <=0.355 (1/3) | 0.0053 | 60.4762 | 39.5185 |
| | | | <=0.727 (2/3) | 33.3333 | 33.3333 | 33.3333 |
| | | | >0.727 (3/3) | 66.9164 | 16.5418 | 16.5418 |
| | | <=1000 (2/3) | <=0.355 (1/3) | 33.3333 | 33.3333 | 33.3333 |
| | | | <=0.727 (2/3) | 33.3320 | 33.3359 | 33.3320 |
| | | | >0.727 (3/3) | 0.0758 | 99.8535 | 0.0706 |

| Table S7. Conditional Probability Distribution for Median Household Income | | | | | | |
|---|---|---|---|---|---|---|
| Soil Pb > 100 ppm | House Value | Distance to Major Road | % Black | <=0.255 (1/3) | <=0.47 (2/3) | >0.47 (3/3) |
| | | >1000 (3/3) | <=0.355 (1/3) | 33.3333 | 33.3333 | 33.3333 |
| | | | <=0.727 (2/3) | 33.2223 | 33.5553 | 33.2223 |
| | | | >0.727 (3/3) | 33.3333 | 33.3333 | 33.3333 |

## 8. Conditional probability distribution for soil PH.

| Table S8. Conditional Probability Distribution for Soil pH | | | | | | |
|---|---|---|---|---|---|---|
| Soil Pb > 100 ppm | House Age | % Black | Median Household Income | <=5.316 (1/3) | <=5.974 (2/3) | >5.974 (3/3) |
| 0 | <=4.2 (1/3) | <=0.355 (1/3) | <=0.255 (1/3) | 0.0154 | 0.0154 | 99.9692 |
| | | | <=0.47 (2/3) | 0.0123 | 99.9753 | 0.0123 |
| | | | >0.47 (3/3) | 29.1667 | 12.5003 | 58.3329 |
| | | <=0.727 (2/3) | <=0.255 (1/3) | 0.0066 | 0.0066 | 99.9868 |
| | | | <=0.47 (2/3) | 0.0154 | 0.0154 | 99.9692 |
| | | | >0.47 (3/3) | 25.0013 | 0.0051 | 74.9936 |
| | | >0.727 (3/3) | <=0.255 (1/3) | 0.0011 | 0.0011 | 99.9978 |
| | | | <=0.47 (2/3) | 0.0011 | 36.6785 | 63.3203 |
| | | | >0.47 (3/3) | 33.3112 | 33.3112 | 33.3775 |
| | <=7.9 (2/3) | <=0.355 (1/3) | <=0.255 (1/3) | 5.8830 | 0.0007 | 94.1163 |
| | | | <=0.47 (2/3) | 0.0007 | 86.1203 | 13.8790 |
| | | | >0.47 (3/3) | 48.3143 | 29.2136 | 22.4721 |
| | | <=0.727 (2/3) | <=0.255 (1/3) | 11.2597 | 0.0017 | 88.7385 |
| | | | <=0.47 (2/3) | 0.0016 | 0.0016 | 99.9969 |
| | | | >0.47 (3/3) | 0.0069 | 0.0069 | 99.9863 |
| | | >0.727 (3/3) | <=0.255 (1/3) | 6.6250 | 3.6808 | 89.6942 |
| | | | <=0.47 (2/3) | 0.0003 | 7.1915 | 92.8082 |
| | | | >0.47 (3/3) | 32.8888 | 32.8888 | 34.2224 |
| | >7.9 (3/3) | <=0.355 (1/3) | <=0.255 (1/3) | 7.8797 | 0.0016 | 92.1187 |
| | | | <=0.47 (2/3) | 0.0010 | 1.5480 | 98.4511 |
| | | | >0.47 (3/3) | 0.0019 | 0.0019 | 99.9963 |
| | | <=0.727 (2/3) | <=0.255 (1/3) | 0.0943 | 0.0026 | 99.9032 |
| | | | <=0.47 (2/3) | 0.0022 | 0.0022 | 99.9956 |
| | | | >0.47 (3/3) | 0.0154 | 0.0154 | 99.9692 |
| | | >0.727 (3/3) | <=0.255 (1/3) | 22.6011 | 0.0012 | 77.3978 |
| | | | <=0.47 (2/3) | 0.0017 | 0.0017 | 99.9967 |
| | | | >0.47 (3/3) | 33.2736 | 33.2736 | 33.4528 |
| 1 | <=4.2 (1/3) | <=0.355 (1/3) | <=0.255 (1/3) | 0.0616 | 0.0616 | 99.8768 |
| | | | <=0.47 (2/3) | 33.3333 | 33.3333 | 33.3333 |
| | | | >0.47 (3/3) | 33.3333 | 33.3333 | 33.3333 |

| Table S8. Conditional Probability Distribution for Soil pH | | | | | | |
|---|---|---|---|---|---|---|
| Soil Pb > 100 ppm | House Age | % Black | Median Household Income | <=5.316 (1/3) | <=5.974 (2/3) | >5.974 (3/3) |
| | | <=0.727 (2/3) | <=0.255 (1/3) | 0.0308 | 0.0308 | 99.9383 |
| | | | <=0.47 (2/3) | 0.0103 | 0.0103 | 99.9794 |
| | | | >0.47 (3/3) | 25.0019 | 0.0077 | 74.9904 |
| | | >0.727 (3/3) | <=0.255 (1/3) | 0.0015 | 0.0013 | 99.9972 |
| | | | <=0.47 (2/3) | 0.0013 | 0.0013 | 99.9974 |
| | | | >0.47 (3/3) | 33.2787 | 33.2787 | 33.4426 |
| | <=7.9 (2/3) | <=0.355 (1/3) | <=0.255 (1/3) | 0.0015 | 0.0015 | 99.9969 |
| | | | <=0.47 (2/3) | 0.0034 | 0.0034 | 99.9932 |
| | | | >0.47 (3/3) | 7.6941 | 92.3035 | 0.0024 |
| | | <=0.727 (2/3) | <=0.255 (1/3) | 43.9992 | 0.0025 | 55.9983 |
| | | | <=0.47 (2/3) | 0.0023 | 0.0023 | 99.9953 |
| | | | >0.47 (3/3) | 0.0103 | 0.0103 | 99.9794 |
| | | >0.727 (3/3) | <=0.255 (1/3) | 23.8443 | 0.0005 | 76.1552 |
| | | | <=0.47 (2/3) | 0.0003 | 0.0003 | 99.9994 |
| | | | >0.47 (3/3) | 32.2442 | 32.2442 | 35.5116 |
| | >7.9 (3/3) | <=0.355 (1/3) | <=0.255 (1/3) | 30.8422 | 0.0027 | 69.1551 |
| | | | <=0.47 (2/3) | 0.0036 | 23.5305 | 76.4659 |
| | | | >0.47 (3/3) | 0.0123 | 0.0123 | 99.9753 |
| | | <=0.727 (2/3) | <=0.255 (1/3) | 51.3205 | 0.0062 | 48.6733 |
| | | | <=0.47 (2/3) | 0.0015 | 0.0015 | 99.9971 |
| | | | >0.47 (3/3) | 0.0103 | 0.0103 | 99.9794 |
| | | >0.727 (3/3) | <=0.255 (1/3) | 9.7722 | 0.0005 | 90.2273 |
| | | | <=0.47 (2/3) | 0.0005 | 0.0005 | 99.9989 |
| | | | >0.47 (3/3) | 33.0829 | 33.0829 | 33.8343 |

## 9. Conditional probability distribution for soil sampling location

| Table S9. Conditional Probability Distribution for Soil Sampling Location | | | | |
|---|---|---|---|---|
| Soil Pb > 100 ppm | House Value | Dripline | Streetside | Yard |
| 0 | <=1.292 (1/3) | 13.4721 | 16.1778 | 70.3501 |
| | <=2.859 (2/3) | 18.4386 | 19.0152 | 62.5462 |
| | >2.859 (3/3) | 3.6152 | 23.4434 | 72.9414 |
| 1 | <=1.292 (1/3) | 26.2730 | 23.7631 | 49.9639 |
| | <=2.859 (2/3) | 36.3835 | 31.0676 | 32.5490 |
| | >2.859 (3/3) | 99.8632 | 0.0695 | 0.0673 |

## 10. Box plot of distribution of soil Pb data at three sampled locations

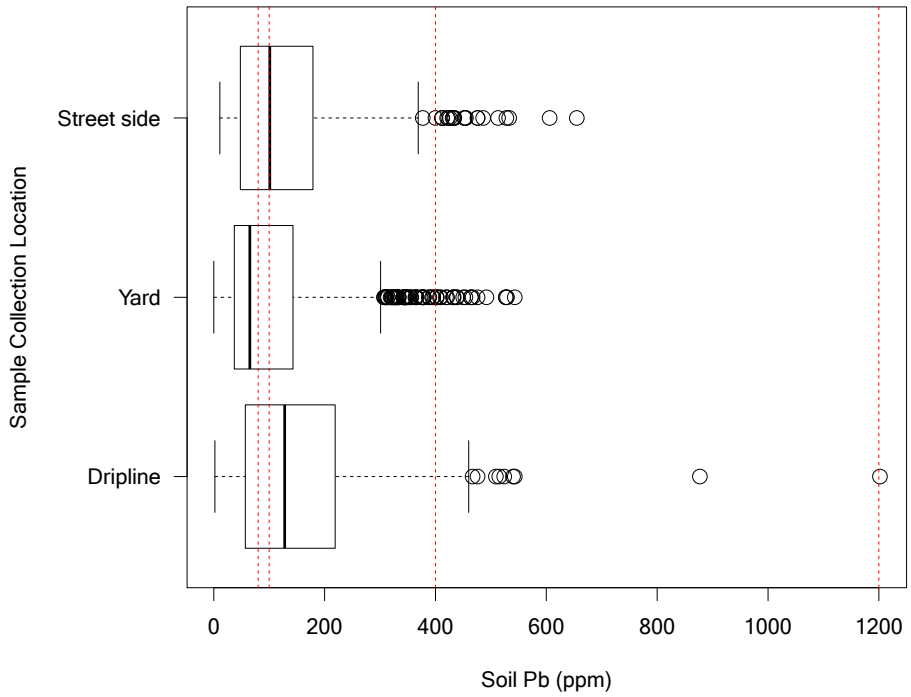


**Figure S1.** Soil Pb was highest at the household dripline and lowest in yard samples. Dashed lines show the following standards: California EPA residential soil standard (80 ppm), U.S. EPA garden soil standard (100 ppm), U.S. EPA play area standard (400 ppm), U.S. EPA residential standard (1,200 ppm).

**11. Total influence of each variable in the model in figure 2 on the probability that soil Pb will exceed 100 ppm.**

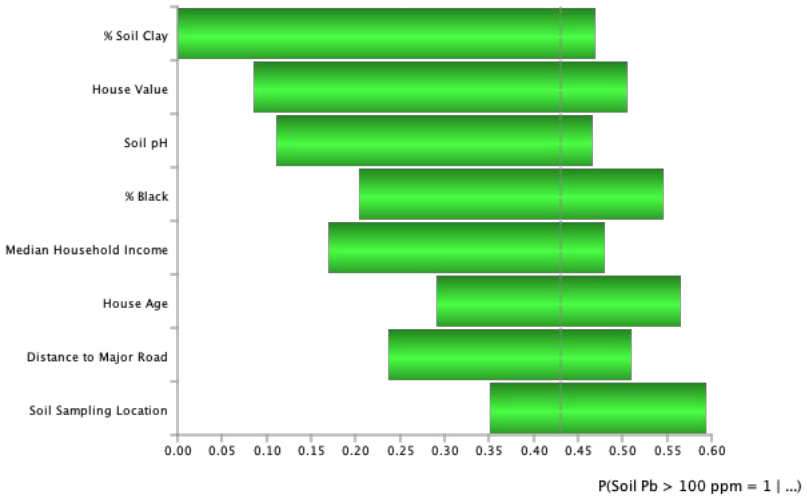


**Figure S2.** Total influence of each variable in the model in Figure 2 on the probability that soil Pb will exceed 100 ppm. The width of each bar indicates the total amount by which this probability can change as values of the variable on the vertical axis are changed.

## References


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