# Improving Positional Accuracy In The Multi-Ethnic Study of Atherosclerosis and Air Pollution.

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## INTRODUCTION

Air pollution has been associated with adverse human health effects, with strong links to increased heart disease, respiratory problems, and strokes [1]. Since transportation emissions are a major source of air pollution [3], it is very important to characterize human exposure to vehicle exhaust.

Exposures to traffic exhaust are often estimated using personal proximity to traffic sources using Geographic Information System (GIS) software. GIS enables researchers to examine relationships between health and the geographic features of a person's environment [1] but positional inaccuracy can result in exposure misclassification [4].

This project is aimed to improving positional accuracy in the Multi-Ethnic Study of Atherosclerosis and Air Pollution (MESA Air) by characterizing the distance between the roadway edge (where a home is geo-coded) to the actual home location.

## METHODS

**Data Sources**

• Measurements of property depth were collected at 83 homes in Chicago, IL as part of MESA Air. Property depth was defined as the distance between the edge of the roadway and the participant's front door.

• Personal and neighborhood information on the 83 participants were obtained from study questionnaires. Additional data about participant neighborhoods was obtained by merging the geo-coded locations with US Census 2000 data (http://www.census.gov/main/www/cen200.html) using ArcGIS Version 9.1(ESRI,Olympia,WA).

**Statistical Analysis**

• All property depth data were log-transformed prior to analysis as the data was highly skewed.

• We examined US Census variables such as average household size, %families, average family size, and population density as well as neighborhood information such as safety and building type as predictors of property depth. Variables were examined in univariate and multi-variate models using R Version 2.5.1 (http://www.r-project.org/).

• We retained all variables with p-values less than 0.2 and report a crude $R^2$.

## CITATIONS

1.Nuckols J.R, Ward M.H, Jarup Lars. (2004).Using Geographic Information Systems for exposure Assessment in Environmental Epidemiology studies. Environmental Health Perspectives. 112:1007-1015.

2. Brook Robert D., Franklin B, PhD, Chair et al. Air pollution and cardiovascular disease. A statement for Healthcare Professional from the Expert Panel on Population and Prevention Science of the American Hearth Association. *Circulation*.2004; 109 2655-2671

3. Union of Concerned Scientists. Citizens and Scientists for Environment Solutions. http://www.ucsusa.org/clean_vehicles/vehicles_health/cars-trucks-air-pollution.html Accessed August 2, 2007

4. Bonner MR, Han D, Nie J et al. Positional Accuracy of Geo-coded Addresses in Epidemiologic Research. Epidemiology. 14:408-412.

## DATA

**Table 1: Property Depth (meters) By House and Neighborhood Characteristics.**

| | N (%) | Median (Range) |
|---|---|---|
| **All participants** | 83 (100) | 7.62 (2.44-30.48) |
| **Population density (#/km²)** | | |
| 0-10,000 | 71 (85..5) | 7.6 (3.1-30.5) |
| >10,000 | 12 (14..5) | 5.3 (2.4-10.7) |
| **Safe Neighborhood** | | |
| Yes | 21 (25.3) | 10.7 (3.1-22.9) |
| No | 62 (74.7) | 2.4 (30.4) |
| **Single Family Home** | | |
| Yes | 48 (57.8) | 6.9 (2.4-30.4) |
| No | 35 (42.2) | 7.6 (3.7-30.4) |
| **Race** | | |
| White | 40 (48.2) | 6.1 (2.4-30.4) |
| Chinese | 24 (28.9) | 10.7 (4.6-22.9) |
| African American | 19 (22.9) | 7.6 (3.1-18.3) |
| **% Families** | | |
| 0-65 | 41 (49.4) | 6.1 (2.4-30.5) |
| >65 | 42 (50.6) | 3.1 (30.5) |
| **Average Family Size** | | |
| 0-3 | 37 (44.6) | 6.1 (2.4-30.5) |
| >3 | 46 (55.4) | 9.1 (3.1-30.5) |
| **Building Age (yrs)** | | |
| 0-60 | 53 (63.9) | 9.1 (3.1-30.5) |
| >60 | 30 (36.1) | 9.1 (3.1-30.5) |

**Table 2: Multivariate analysis $R^2 = 0.34$**

| Parameter | Effect Estimate | Standard Error | T value | P Value |
|---|---|---|---|---|
| **Safety** | 2.123e-01 | 1.279e-01 | 1.660 | 0.100981 |
| **Population density** | -4.141e-01 | 1.077e-05 | -3.844 | 0.000247 |
| **Building year** | -3.921e-03 | 1.796e-03 | -2.183 | 0.032103 |
| **Income <16k** | - | - | - | - |
| **Income 16-35k** | 2.123e-01 | 1.279e-01 | 1.660 | 0.100981 |
| **Income >35k** | -3.050e-01 | 2.347e-01 | -1.300 | 0.197616 |

**Fig 1: Property depth vs. Building year.**

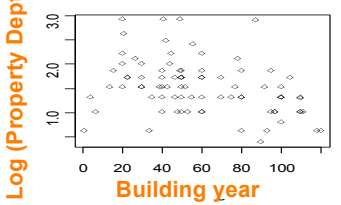



**Fig 2: Property depth vs. Population density .**

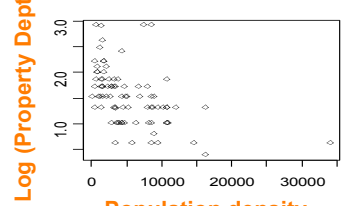



**Fig 3: Property depth vs. Safety.**

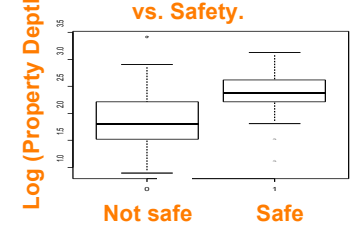
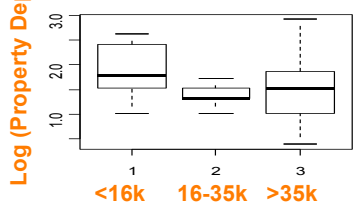



**Fig 4: Property depth vs. Income.**




## CONCLUSIONS

In a multivariate model, we found that four factors explained 34% of the variability in property depth where:

- Safe neighborhoods have larger lot sizes.
- Newer buildings have smaller lot sizes.
- As population density increases property depth decreases.

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