Association Between Urban Street Noise and Neighborhood Crime: A Pilot Study

Tara P. McAlexander, BA; Richard Neitzel, CIH, PhD; Robyn R.M. Gershon, MHS, DrPH

Columbia University MAILMAN SCHOOL OF PUBLIC HEALTH

SCHOOL OF PUBLIC HEALTH UNIVERSITY of WASHINGTON

Introduction

- "**Soundscapes**," the auditory equivalent of landscapes, are of increasing interest with respect to quality of life in urban communities.
- Chronic noise is an environmental stressor that can adversely impact quality of life, physical and mental health.
- Neighborhood crime also adversely impacts quality of life and is related to average income.
- The extent to which street-level noise is associated with neighborhood crime in an urban setting is unknown.
- Vehicle traffic is a common source of chronic noise exposure.

Purpose

A pilot study was conducted to:
- Describe and visualize the urban soundscape by measuring noise levels on the decibel scale (**Figure 1**).
- Determine the influence of average income on the spatial correlation between street-level noise and neighborhood crime in New York City.
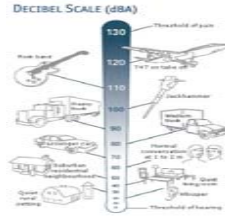

Figure 1. Noise level references on the decibel scale (dBA). http://vancouver.ca/engsvcs/projects/soundsmart/sound AndNoise.htm

Methods

- Using time-integrated dosimetry, noise levels of 60 road/street (e.g., sidewalks) and public areas (e.g., outdoor public gathering spaces) were measured throughout Manhattan, New York City (NYC) in 2010.
- 90% of sites were selected based upon a map of 311 noise complaint calls in local NYC neighborhoods (high, medium, and low call rates).
- 10% of sites were selected as "high interest" public spaces (e.g., Times Square, Columbus Circle, etc.).
- Measurements were taken for 10-minute intervals between the hours of 9:00 AM- 5:00 PM, Monday-Friday. Nearest street intersection and address were recorded to generate geographic coordinates.
- Measurements were mapped using ArcGIS software, and estimate noise levels were generated for the rest of Manhattan using inverse-distance weighted interpolation (nearest 3-5 data points).
- Distance from each sample to the nearest designated truck route was calculated using the distance tool in ArcGIS.
- Corresponding U.S. Census Data for median household income and crime incidence were also mapped using ArcGIS (2006-2008) data.
- Correlation coefficients were calculated to determine spatial correlation between each of the three variables.

Results

- The average noise levels (L_{eq}) for the 10-minute readings of the 60 sites in Manhattan were typically at or above 70 dBA, the 24-hour average limit for community noise exposure recommended by the EPA and WHO.
- The minimum, maximum, mean and median levels of noise (L_{eq}) are displayed in **Table 1**.

Minimum L_{eq} (dBA)	Maximum L_{eq} (dBA)	Mean L_{eq} (dBA)	Median L_{eq} (dBA)
68.7	77.6	72.8	72.6

Table 1. Minimum, Maximum, Mean and Mean L_{eq} levels (dBA) for the 60 sites sampled in Manhattan.

- Noise L_{eq} values were significantly correlated with proximity to major truck routes (**Figure 2**, p=0.03).

Figure 2. Regression analysis between the average recorded noise level (dBA) and the distance (in meters) from that point to the nearest major truck route in Manhattan. R^2=0.0268.
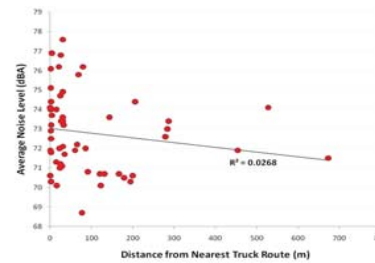
- No significant correlation was found between noise and median household income, nor between noise and crime incidence. Significant correlations were found between economic and crime variables.
- A "heat map" was created to visualize correlations between all variables analyzed. Significant correlations were found between median household income and crime incidence as well as between noise levels and distance to major truck routes (**Figure 3**).
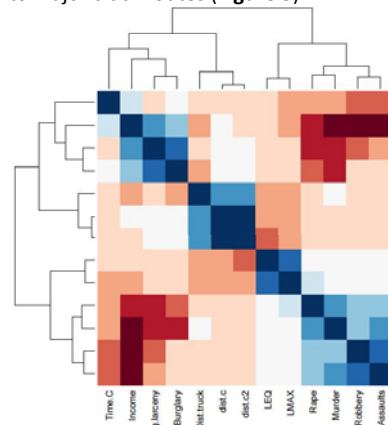

Figure 3. "Heat map" of correlations between all variables observed. Red indicates a negative correlation, and blue indicates positive correlation. The stronger the hue, the stronger the correlation between two variables.

- Based on the readings from the 60 sites within Manhattan, a GIS map of estimated noise levels in Manhattan was generated, with a range of 68.7 to 77.6 dBA (**Figure 4**).
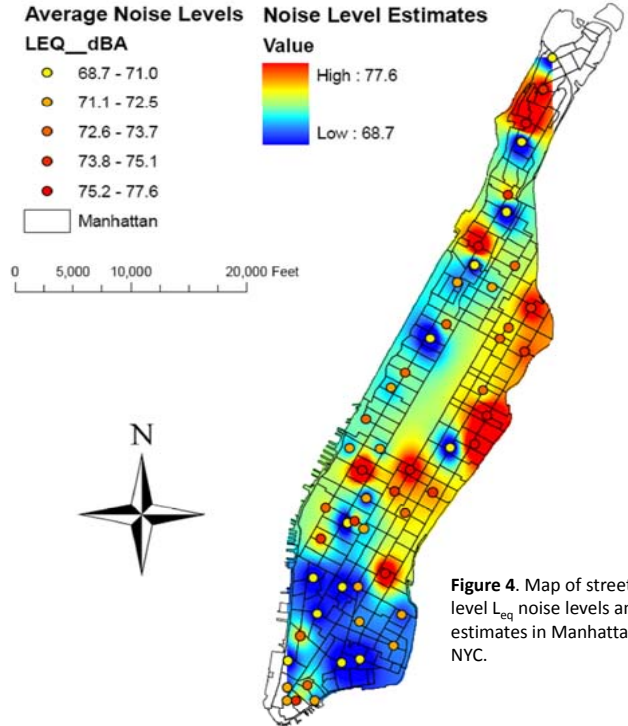

Average Noise Levels
LEQ__dBA
- 68.7 - 71.0
- 71.1 - 72.5
- 72.6 - 73.7
- 73.8 - 75.1
- 75.2 - 77.6
- Manhattan

Noise Level Estimates
Value
High : 77.6
Low : 68.7

0   5,000   10,000   20,000 Feet

Figure 4. Map of street-level L_{eq} noise levels and estimates in Manhattan, NYC.

Conclusions

- **98% of the noise levels of public spaces in NYC exceeded recommended community noise levels.**
- Locations near truck routes had higher observed noise levels.
- Adverse impacts on hearing, health and quality of life can result from excessive exposure.
- Preliminary analysis did not indicate significant correlations were found in this study between street noise and crime rates, possibly indicating data refinement challenges.
- This information is useful to public health, urban planners, and policy makers and is an important first step towards risk reduction with regard to noise exposure.