

Cardiovascular Disease and Airport Noise Exposure Project 03

Project manager: N. Sizov/M. Marsan, FAA
Lead investigator: J. Peters, Boston University School of Public Health

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Linkage to AEE Roadmap

- Health Impacts of Aviation Noise
 - To investigate the risks of cardiovascular outcomes associated with noise-related exposures

Goal of the Project

- Aims to evaluate the relationship between aircraft noise exposure and cardiovascular health by linking with existing national longitudinal health cohorts – Nurses' Health Study (NHS)/Health Professional Follow-up Study (HPFS) – for which detailed individual data and high geographical resolution are available.

Schedule and Status



- March 2015: Obtain noise estimates
 - Actual date received noise models: November 2017 – March 2018
 - Received 2000, 2005, 2010, 2015 data
- November 2016: Link noise exposure with cohort data
 - New projected date: July 2018
- January 2017: Determine relevant cardiovascular outcomes
 - Completed
- March 2017: Determine number of participants residing near airports and develop analysis plan of noise-health
 - Determined based on 2009 noise data
 - Developed/presented/obtained approval for two analysis plans – (1) Noise-hypertension and (2) Noise-cardiovascular disease.

Approach and Accomplishments



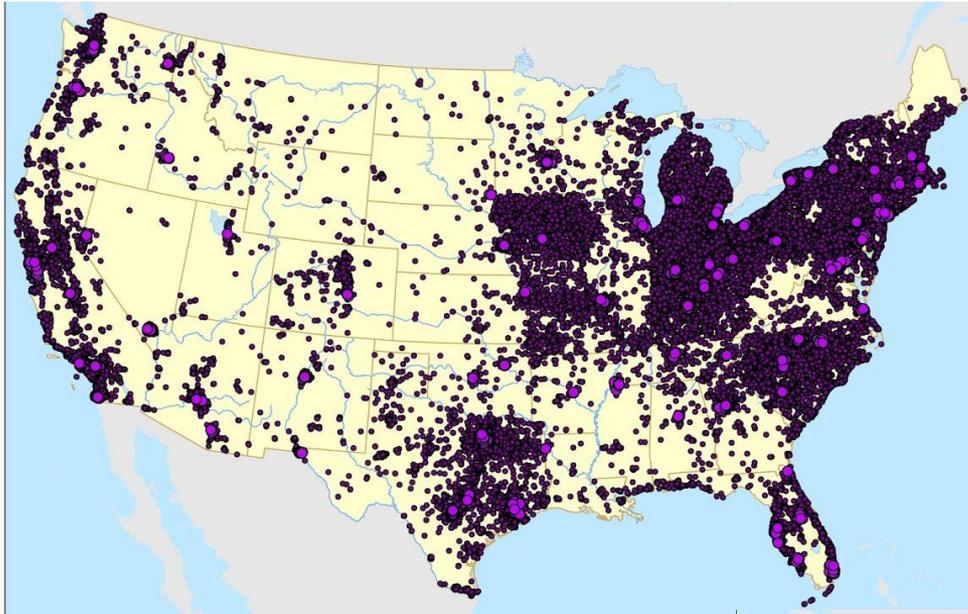
- Performed extensive analyses of noise contours and exposure estimates.
 - Collaborated with Volpe to receive rerun of all Wyle noise estimates and perform quality assurance/quality control on all noise estimates.
- Processed the noise data to useable format
- Linked the noise data to geocoded addresses for NHS (original) and determined participant noise exposure estimates.
- Investigated noise trends over time
- Performed preliminary analysis of association between noise and hypertension.

Study Population: NHS, NHSII, HPFS



- **Nurses' Health Study**
 - Began 1976, includes 121,701 women, registered nurses living in 11 populous states at enrollment
 - At noise study baseline (1995) - 96,000 alive and free of CVD
- **Nurses' Health Study II**
 - Began 1989, includes 116,430 women, registered nurses living in 14 populous states at enrollment
 - At noise study baseline (1995) - 115,000 alive and free of CVD
- **Health Professional's Follow-Up Study**
 - Began 1986, includes 51,529 men
 - Dentists, pharmacists, optometrists, osteopath physicians, podiatrists, and veterinarians throughout the US
 - At noise study baseline (1995) - 50,000 alive and free of CVD
- **Biennial follow-up with mailed questionnaires**
 - Each collects information on risk factors (e.g. diet, physical activity, smoking, hormone use) and occurrence of diseases

Results: Participants

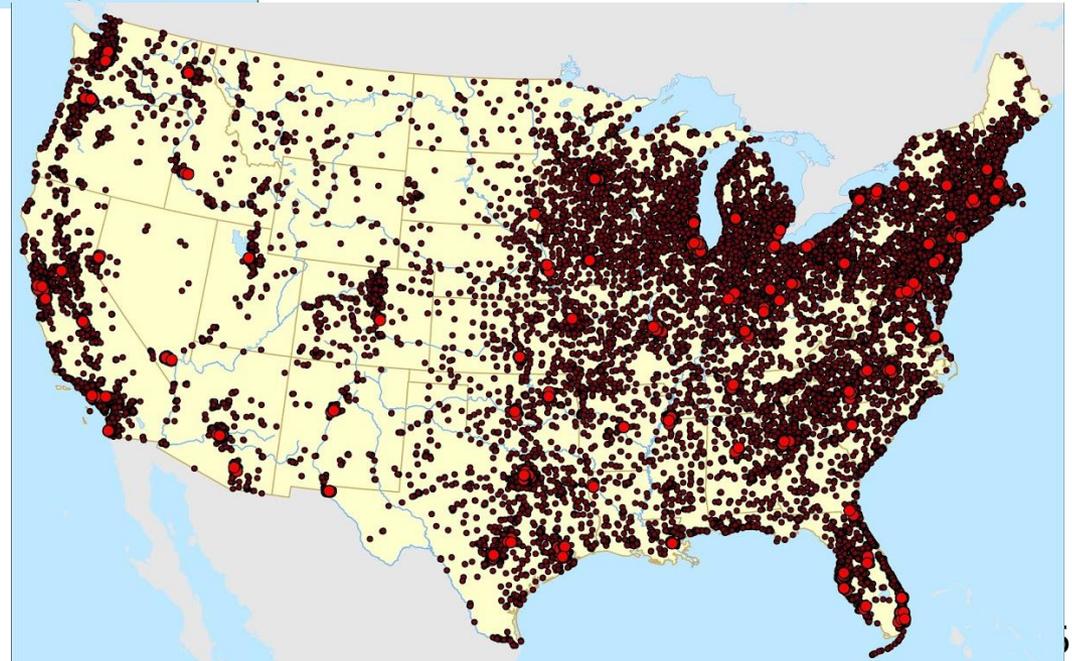


Exposed to \geq DNL 45 dB
(2009)

← NHS: 5,666
NHS II: 5,802

Exposed to \geq DNL 45 dB
(2009)

→ HPFS: 2952



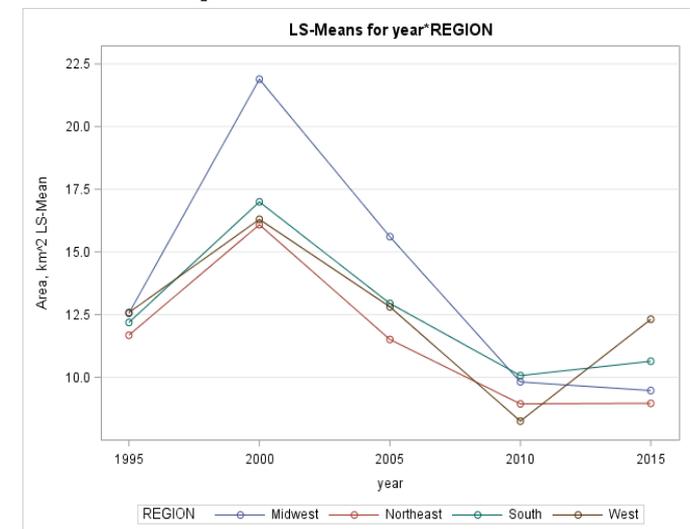
Results: Noise Modeling

Methods

- Utilized linear fixed effects models to estimate changes in sizes of exposure areas by U.S. Census regions/divisions for ≥ 65 dB and ≥ 55 dB

Results

- Found non-monotonic trends in mean exposed areas for both ≥ 55 and ≥ 65 dB DNL over time that peaked in 2000
 - Exposed areas largest in the Midwest region from 2000 to 2005
 - After 2000, only the West region increased from 2010 to 2015



Preliminary Results: Noise and Hypertension in NHS only



- Methods
 - Determined hypertension cases from self-report.
 - Performed time-varying Cox proportional hazards models for hypertension incidence for:
 - 1 dB increase in current DNL and cumulative average DNL
 - Indicators for being above 45 dB and 55 dB
 - Adjusted for individual risk factors for hypertension, area-level socioeconomic status, and 24-month moving average particulate matter between 2.5 and 10 microns (PM_{2.5-10}) and less than 2.5 microns (PM_{2.5})
- Preliminary Result
 - Number free of hypertension at 1994: 63,600
 - Number of new cases of hypertension 1994-2007: 28,286
 - For each year, ~10% of participants exposed to DNL >45 dB
 - No association with 1 dB increase in current DNL and cumulative average DNL
 - Positive associations with being over 45 dB (HR=1.04; 95%CI: 0.99, 1.09) and over 55 dB (HR=1.03; 95%CI: 0.89, 1.18)

Summary



- Next steps
 - Linking all noise exposure metrics with cohort data
 - Performing detailed analysis for all three cohorts (NHS, NHSII, HPFS) to evaluate associations between noise and health
- Key challenges/barriers
 - Dealing with exposure misclassification related to non-modeled aircraft exposure – e.g., living near large military base.
 - Determining correct modeling approach to deal with 'zero-inflated' data (i.e., ~large proportion of non-exposed, ~90% of participants)

Publications

- N/A

Contributors

- BUSPH: Junenette Peters, Jonathan Levy
- Harvard: Francine Laden, Jamie Hart

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- Correia AW, Peters JL, Levy JI, Melly S, Dominici F. Residential exposure to aircraft noise and hospital admissions for cardiovascular diseases: multi-airport retrospective study. *BMJ*. 2013;347:f5561.
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- Between Noise PIs
 - Pennsylvania State University with NIH funding

- Other
 - Volpe Transportation Center
 - *Potential:* Project 17 (Aircraft Noise and Sleep Disturbance)