Pilot Study on Aircraft Noise and Sleep

Project 17

Lead investigator: M. Basner, University of Pennsylvania
Project manager: N. Sizov, FAA

April 18 & 19, 2017
Alexandria, VA

Introduction

- Field studies need to be conducted in the US to acquire current data on sleep disturbance relative to varying degrees of aircraft noise exposure to inform policy
- An inexpensive methodology of using actigraphy and electrocardiography (ECG) has previously been found to provide a sensitive measure of awakenings
- We established the feasibility of having study participants complete unattended ECG and actigraphy measurements in a 3 night study near Philadelphia Airport
- Based on lessons learned from the Philadelphia study, the methodology was further refined and a second pilot study is being conducted near another US airport

Objectives

- Establish feasibility of unattended acquisition of acoustic and physiologic field data (no field staff)
- Determine field study recruitment methodology that maximizes response rate and minimizes cost
- Begin sample size calculation for a potential National Sleep Study based on data gathered at US and German airports
- Refine methodology for automatically detecting aircraft noise events in recorded sound files

Schedule and Status

Period	Tasks
10/2015-9/2016	**Study Preparation:**
	• Design recruitment questionnaire
	• Develop study protocol and obtain IRB approval
	• Determine airport and obtain flight operations, predict L_{night} levels and number of overflights, identify sampling regions based on predictions
9/2016-9/2017	**Data Acquisition:**
	• Mail out recruitment questionnaires
	• Mail out equipment for in-home sleep study
	• Target: up to 500 surveys, 100 in-home study participants

Approach-Recruitment Survey

- Brief surveys are mailed to randomly selected households in 10 sampling regions:
  - 5 sampling regions east and west of the airport
  - Noise categories: (control region) < 40 dB, 40-45 dB, 45-50 dB, 50-55 dB, and > 55 dB Lnight
- Survey contains sleep, health, and demographic questions
- Primary purpose of survey is to determine eligibility for an in-home sleep study
- Participants indicate whether they would like to take part in the home sleep study on the survey
- The survey can be returned using a prepaid envelope or it can be completed online

Recruitment Survey

The following parameters were varied:

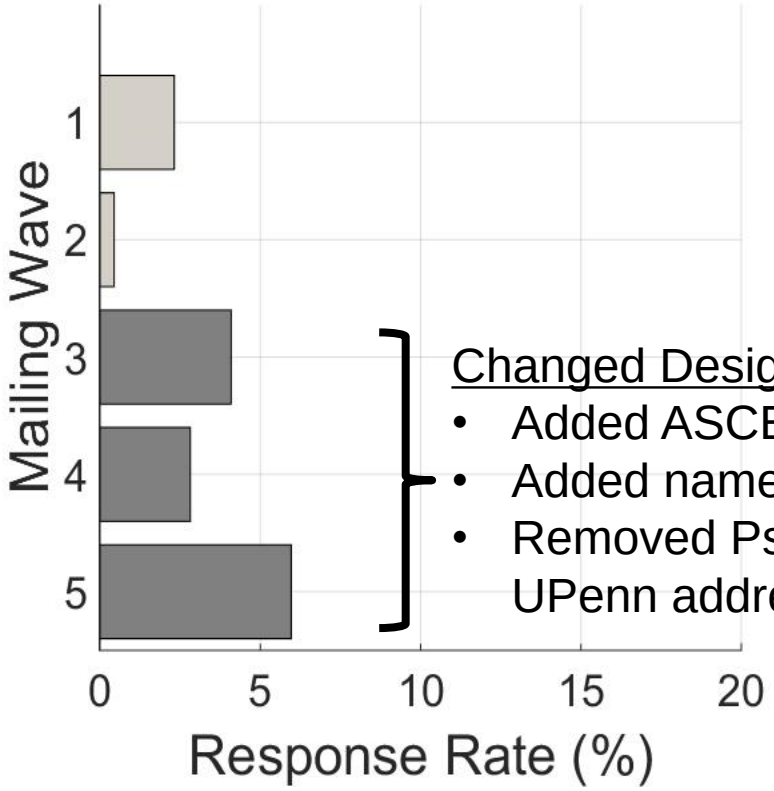
Each mailing wave consists of 240 addresses

Surveys are mailed in waves until we obtain target enrollment

- **Incentive for returning the survey**
  - Promised $2, $5, or $10 Amazon gift card (waves 1-5)
  - Pre-paid $2 cash (waves 6-9)
- **Survey length**
  - Long (waves 1-7)
  - Medium (contains all eligibility questions, wave 8)
  - Short (additional telephone screening necessary, wave 9)
- **Subject payment for field study**
  - $100 (waves 1-5)
  - $150 (waves 6-9)
- **Survey follow-up**
  - No follow-up (waves 1-4)
  - Pre-notification postcard (wave 5)
  - 3-wave follow-up (waves 6-9)

Survey Response Rate

- Response rates are calculated separately for each mailing wave to determine optimal recruitment method
- Response rates are the % of surveys that were returned, non-deliverable surveys were removed for the calculations

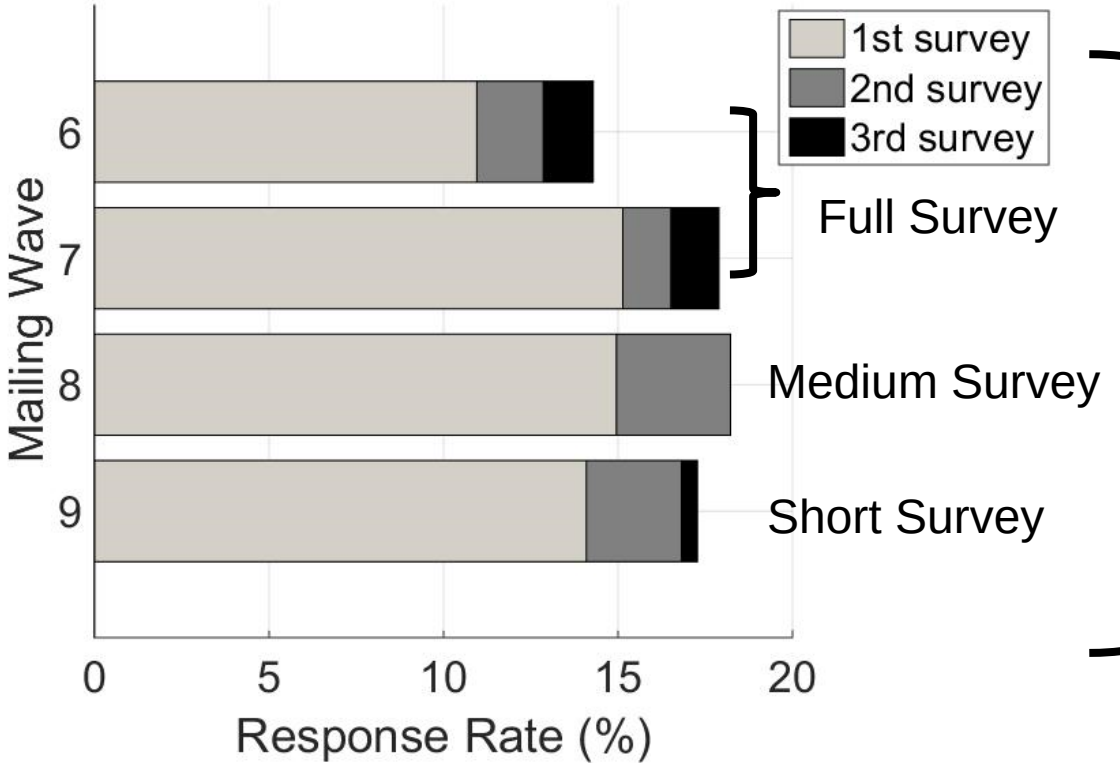


Changed Design of Envelopes:
- Added ASCENT Logo
- Added name with address
- Removed Psychiatry from UPenn address

Compensation:
- Survey- Amazon Gift Card ($2, 5 or 10)
- In Home Study-$100

Response rate did not vary by gift card amount:
$2.00-11 surveys, $5.00-12 surveys, $10.00-11 surveys

Survey Response Rate



<u>3 waves of follow-up</u>:
- 1 Reminder postcard (1wk)
- 2nd Copy of survey (3 wks)
- 3rd Copy of survey (6 wks)*

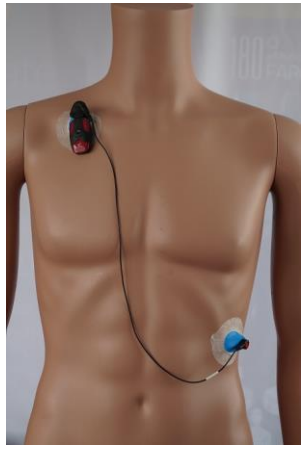
<u>Compensation</u>:
- Survey-$2.00 cash
- In Home Study-$150

- Response rate did not increase by decreasing survey length
- Response rate increased with follow-up and change in compensation

*Still receiving surveys

Approach-In Home Study

- Equipment is mailed to participant's homes
- An instruction manual and videos are provided on how to use the equipment
- Physiological Monitoring: 2 cable (1 channel) ECG (1 kHz) and body movements (10 Hz)
- Sound recording equipment: Portable audio recorder with class 1 microphone
- Total equipment cost for 1 setup $1,130
- Participants take part for 5 consecutive nights
- Staff are available by cell-phone to answer questions



In Home Study-Response Rate

Total Surveys Mailed (End of March): 2160
Total Surveys Received (End of March): 178

	Survey response rate	Interested in in-home study	Interested and Eligible for in-home study
PHL Study	NA	4.0 %	3.2%
Waves 1-5 Long survey, Amazon gift cards, $100 payment, no follow-up	3.0%	2.2%	0.6%
Waves 6-7 Long survey, $2 cash, $150 payment, follow-up	16.1%	8.4%	4.0%
Wave 8 Medium survey, $2 cash, $150 payment, follow-up	17.8%	11.2%	4.2%
Wave 9 Short survey, $2 cash $150 payment, follow-up	16.8%	10.9%	3.1%

Status of in-home measurements (end of March):
5 completed, 10 scheduled, waiting to receive 8 additional consent forms

Summary

- **Summary statement**
  - The recruitment survey response rate was increased relative to the Philadelphia study.
  - Changes that did not improve response rate:
    - Amount of gift card
    - Survey length
  - Changes that did improve response rate:
    - Redesign of envelopes
    - Payment increase for in-home study
    - Pre-paid compensation for survey ($2.00 cash)
    - Follow-up mailings
- **Next steps**
  - Continue with mailing of recruitment surveys and determine additional changes that can be made to increase response rate
  - Continue with in-home measurements to establish feasibility of methodological approach

Acknowledgements

- FAA has a cooperative agreement with DLR. The ECG and actigraphy methodology was jointly refined with colleagues from DLR.

Publications

- Basner, M., McGuire, S., Witte, M. Pilot sleep study near Philadelphia International Airport. ASCENT Project 17 Report.
- Basner, M., Clark, C., Hansel, A., Hileman, J.I., Janssen, S.A., Shepherd, K., Sparrow, V.: Aviation noise impacts: state of the science. Noise & Health, accepted for publication

Participants

- Mathias Basner (PI), University of Pennsylvania
- Sarah McGuire (Research Assistant Professor), University of Pennsylvania
- Maryam Witte (Research Assistant), University of Pennsylvania