JFK Airport, Our Environment and Our Health!

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EFFECTS OF NOISE EXPOSURE
Understanding the Biology of Noise

噪声被定义为“不想要的声音”并被视为环境压力和干扰。

- 什么发生在身体下暴风雨般的噪音冲击下？

  ~ 它触发了我们的“战斗或逃跑”反应

  ~ 血压上升，心率加快，压力荷尔蒙激增。

  ~ 这些都是可成为心血管疾病前兆的条件。

- 即使在对听力无害的水平，我们的身体也会无意识地感知到噪音是一种危险信号—包括当我们正在熟睡时。

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What Depicts Our Responses to Noise?

Responses to noise may depend on characteristics of the sound, including: **intensity**, **frequency**, **vibrations**, **complexity** of the sound, **duration**, **source** and the **meaning of the noise**.

Exposure to continuous noise of 85-90 dBA, typically in industrial settings, can lead to progressive hearing loss.

Noise may influence health directly and not through annoyance.

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What is DNL and dBA?

DNL = Day-Night Sound Level) is based on sound levels measured in relative intensity of sound, or decibels (dB), on the “A” weighted scale (dBA).

This scale most closely approximates the response characteristics of the human ear to sound.

The higher the number on the scale, the louder is the sound.

DNL represents noise exposure events over a 24-hour period. To account for human sensitivity to noise between the hours of 10 p.m. and 7 a.m., noise events occurring during these hours receive a “penalty” when the DNL is calculated. Each nighttime event is measured as if ten daytime events occurred.

To account for increased annoyance when ambient noise levels are lower and people are trying to sleep. DNL may be determined for individual locations or expressed in noise contours.
What is a Noise Contour?

Legend
- Existing (2012/2013) Noise Exposure Contour
- School
- Church
- Library
- Nursing Home
- Residential
- Commercial/Industrial
- Mixed Use
- Open Space
- Recreation
- Transportation
- Airport Property Boundary

Existing (2012/2013) Noise Exposure Contour

Exhibit: 4-2
Noise and Sleep Disturbance

Exposure during sleep may increase blood pressure, heart rate and finger pulse amplitude as well as body movements.

There may be also after-effects during the day following disturbed sleep; perceived sleep quality, mood and performance in terms of reaction times.
Noise Exposure and Performance

- There is good evidence that noise exposure impairs performance.

- Reading, with reliance on memory, may also be impaired.

- Noise reduces helping behavior, increase aggression and reduce the processing of social cues seen as irrelevant to task performance.
Noise and Cardiovascular Disease in the Community

- Aircraft noise exposure around Schiphol Airport, Amsterdam
- Researchers found more medical treatment for heart trouble and hypertension, more cardiovascular drug use and higher blood pressure.
- Adjustments for age, sex, smoking, height/weight and socio-economic differences.
- Swedish study found that the prevalence of hypertension was higher among people exposed >55 dBA (TWA)
Noise and Psychiatric Disorder

- Postulation: Noise creates annoyance → psychological effects

- Unconfirmed, perhaps mental illness increases annoyance

- Psychological symptoms of exposure: nausea, headaches, argumentativeness, mood changes and anxiety

- Community surveys have found high percentages of people reported ‘headaches’, ‘restless nights’, and ‘being tense and edgy’ in high-noise areas

- Early studies have found associations between the level of aircraft noise and psychiatric hospital admission rates both in London and Los Angeles
The mental illness hospitalization rate in Southeast Queens has increased by more than 65% during the past decade.

In 2003-2004, the community’s average annual rate of mental illness hospitalizations (777/100,000) was higher than the Queens rate (636/100,000).
Acoustic Predictors of Noise in Community Surveys

- Primary characteristics affecting the unwantedness of noise is its loudness or perceived intensity.

- High frequency noise has been found to be more annoying than low frequency noise.

- Vibrations are perceived as a complement to loud noise in most community surveys of noise and are found to be important factors in determining annoyance.

- This may be due to the experience of other senses.
Noise and Non-Auditory Health Effects in Children

- Vulnerable group
- Less Cognitive Capacity to understand and anticipate stressors
- Developmental stages: Physically and Mentally → Irreversible negative consequences for this group

- Cognition
- Motivation
- Cardiovascular Effects
- Endocrine Disturbance
- Noise annoyance
Cognition

- Noise exposed children have difficulty in concentrating in comparison with children from quieter schools.

- Chronically exposed children tend to have poorer reading ability and school performance on national standardized tests.

- Example: Railway Noise Exposure → 3-4 months behind.
Test score performance for this area is **BELOW AVERAGE**
Noise contour shadows poor performance
Motivation

A number of studies have identified an association between chronic exposure to aircraft noise and decreased motivation.

L.A. Airport Study: Children exposed to chronic aircraft noise were less likely to solve a difficult puzzle involving a success or failure experience and were more likely to give up.

Munich Study: Noise-exposed children gave up on an insoluble puzzle more quickly than their non-noise-exposed counterparts.
Cardiovascular Effects

In addition to cognitive performance, there is evidence that chronic noise exposure may give rise to physiological effects in terms of raised blood pressure.

L.A. Airport Study, chronic exposure to aircraft noise was found to be associated with raised systolic and diastolic blood pressure.

Increased adrenaline and noradrenaline in children overnight, Munich Airport Study → Increased stress levels.
Conclusions: Long-term aircraft noise exposure may be linked to metabolic outcomes, in particular increased waist circumference.
Conclusions

The evidence for effects of environmental noise on health is strongest for annoyance, sleep and cognitive performance in adults and children.

Dose-response relationships can be demonstrated for annoyance and less consistently for blood pressure.

Perception of control over the noise source may reduce the threat of noise and the belief that it can be harmful.

Adaptation to long-term noise exposure needs further study.

Most people exposed to chronic noise, for instance from major airports, seem to tolerate it. Yet, questionnaire studies suggest that high level of annoyance do not decline over time.
Annoyance

Based on 46 studies of traffic noise and (20 on aircraft, 18 on road traffic and 8 on railway noise) which were performed in Europe, North America and Australia between 1971 and 1993. It is clear that for any given noise level, aircraft noise causes more annoyance than road traffic which in turn causes more annoyance than railway traffic.

Figure 2. The percentage highly annoyed (left panel) and annoyed (right panel) persons as a function of exposure to aircraft, road and railway noise ($L_{den}$).

Source: Adapted from EC 2002.
Table A4. WHO's summary of effects of different levels of night noise on the population's health.

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<tr>
<th>Average night noise level over a year</th>
<th>Health effects observed in the population</th>
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<tr>
<td>Up to 30 dB</td>
<td>Although individual sensitivities and circumstances may differ, it appears that up to this level <strong>no substantial biological effects</strong> are observed. ( L_{\text{night, outside}} ) of 30 dB is equivalent to the no observed effect level (NOEL) for night noise.</td>
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<tr>
<td>30 to 40 dB</td>
<td><strong>A number of effects on sleep</strong> are observed from this range: body movements, awakening, self-reported sleep disturbance, arousals. The intensity of the effect depends on the nature of the source and the number of events. Vulnerable groups (for example children, the chronically ill, and the elderly) are more susceptible. However, even in the worst cases the effects seem modest. ( L_{\text{night, outside}} ) of 40 dB is equivalent to the lowest observed adverse effect level (LOAEL) for night noise.</td>
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<tr>
<td>40 to 55 dB</td>
<td>Adverse health effects are observed among the exposed population. <strong>Many people</strong> have to adapt their lives to cope with the noise at night. Vulnerable groups are more severely affected.</td>
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<tr>
<td>Above 55 dB</td>
<td>The situation is considered increasingly dangerous for public health. Adverse health effects occur frequently, a sizeable proportion of the population is highly annoyed and sleep-disturbed. There is evidence that <strong>the risk of cardiovascular disease</strong> increases.</td>
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Source: WHO 2009.
In terms of **health effects** from aviation noise, the Commission stated that the link between noise and hypertension is ‘fairly well’ established and that the 2008 European HYENA study,
23 percent of the Medicare recipients were exposed to noise greater than 55 decibels—but this group accounted for fully half of the hospitalizations.

If aircraft noise in the high-decibel locations were reduced from 55 to 45 decibels, it could result in 9,000 fewer hospital admissions annually for cardiovascular problems.
What’s lacking for Southeast Queens?

Lack of multi-leveling research analyzing the effects of air traffic noise exposure and its effects on community members, especially vulnerable individuals and students in the area.
Who should bear the burden of the costs?

Tax on Aviation Industry?