

The Effects of Transportation Noise on People – The Current State of Research

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Topics

- Why?
- Documented physiological effects
- Documented psychological effects
- Public concerns

Why?

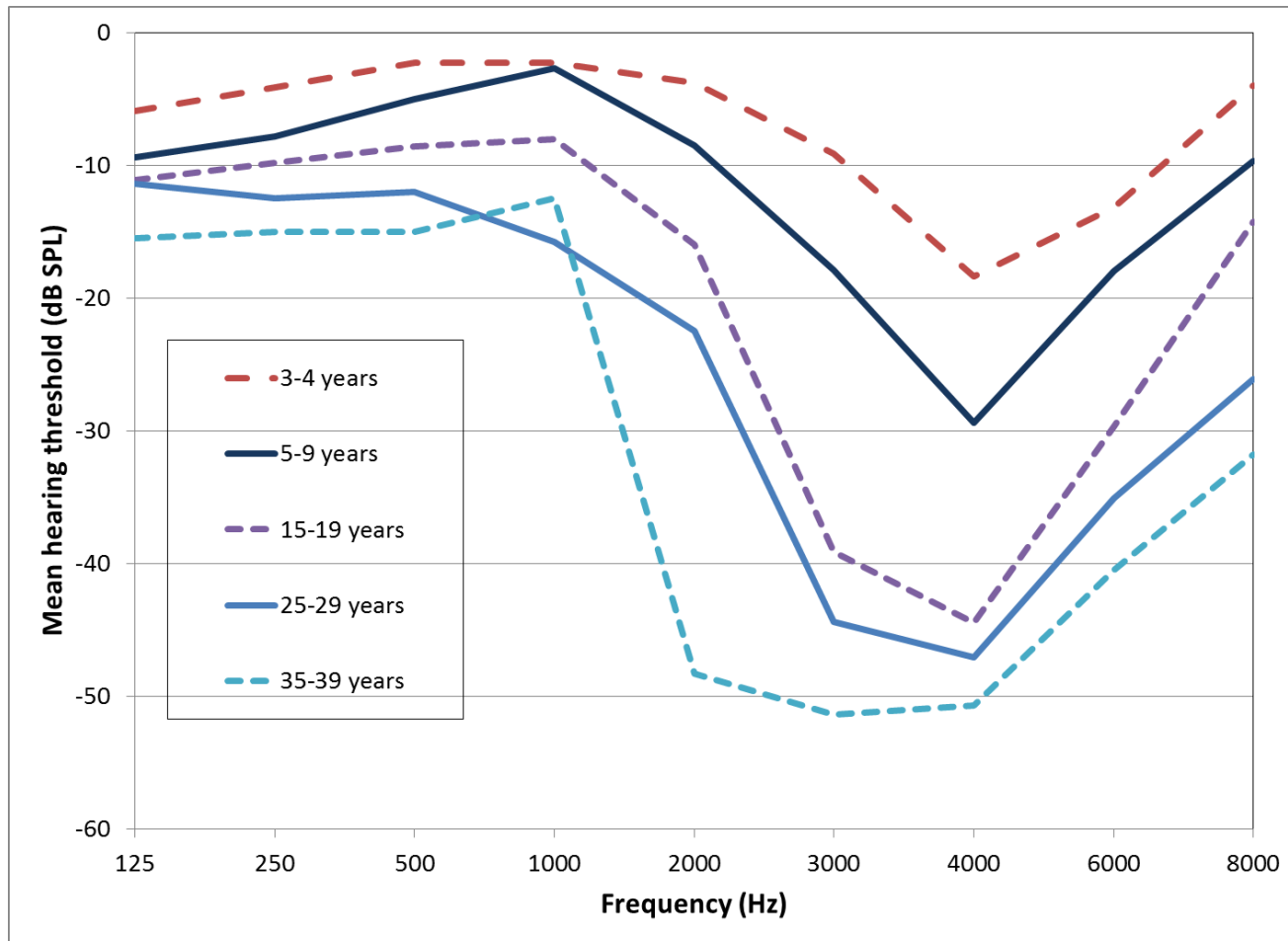
- This should be the basis for our work
 - Sometimes we lose sight of that
- Only addressing negative effects here
 - Yes, there are positive effects associated with sound

Documented Physiological Effects

- Hearing loss
 - well-established
 - not an issue for the public, mainly occupational
- Cardiovascular diseases
- Low frequency/infrasound effects
- Confounding factors (for all effects)
 - demographics, lifestyle, personality type, opinion about source(s), fear, visual, personal sensitivities

Noise-induced hearing loss

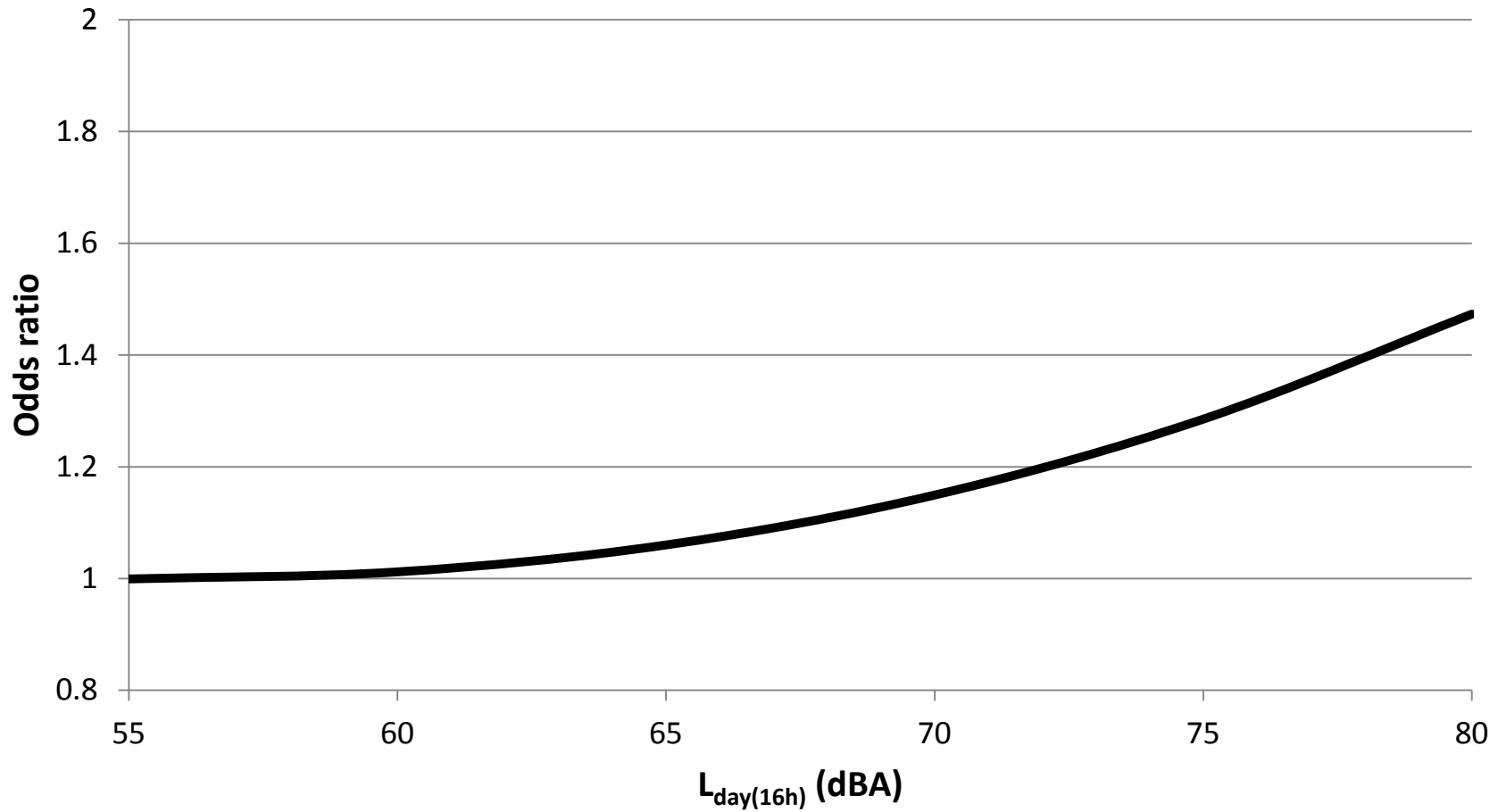
~100 dBA TWA occupational exposure



Cardiovascular Disease Research

- Hypertension (blood pressure)
 - studies mainly for air and traffic
 - HYENA Study (6 countries/airports, 2005-2006)
 - Hypertension and exposure to noise near airports
 - 45-70 ages, various average descriptors
- Ischaemic (blood supply) heart diseases
 - studies mainly for traffic
 - myocardial infarction (heart attack)
 - based on odds ratio
 - arteriosclerosis
 - angina
 - stroke (>60 dBA L_{den} , >64.5 age)

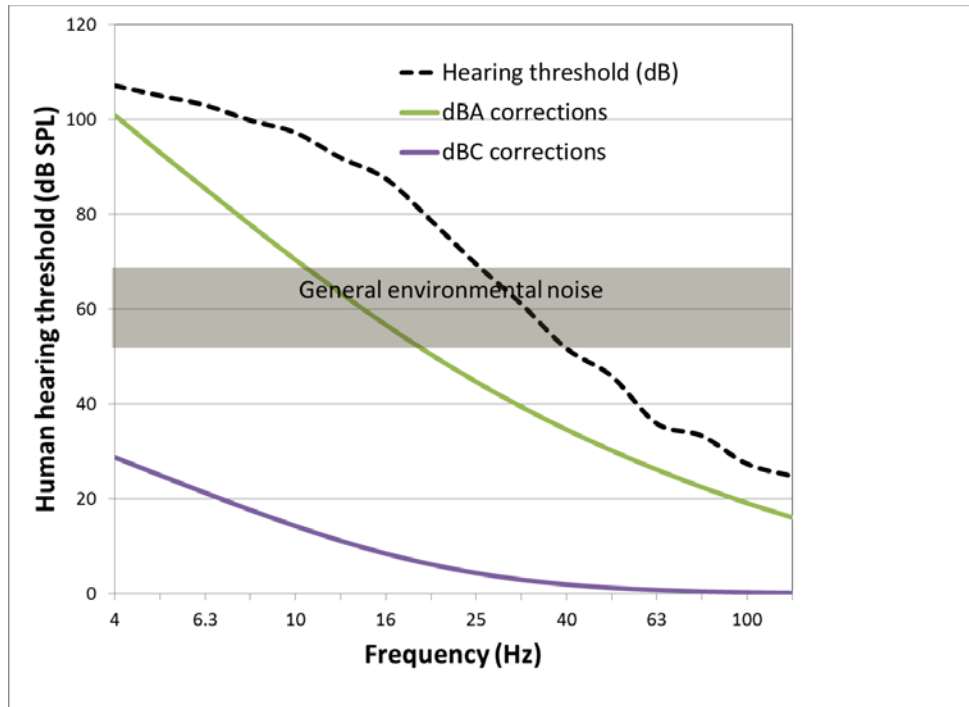
MI dose-response relationship (traffic noise)



Source: Babisch 2008

Low Frequency/Infrasound Research

- LFN (20-200 Hz) vs. infrasound (<20 Hz)
 - perception thresholds very high
 - Is auditory perception required?



Sources: Watanabe and Møller 1991,
ANSI S1.42-2001(R2011)

LFN/Infrasound effects

- Vestibular effects
 - at high levels (>155 dB @20 Hz, 135 dB @1000Hz)
 - nystagmus – at high levels (>110 dB >60 s@20 Hz, >140 dB for infrasound, shorter durations)
 - Visceral Vibratory Vestibular Disturbance (VVVD)
- Potential non-audible effects
 - vibroacoustic disease (VAD) - >90 dB, <500 Hz
 - respiratory (chest resonance @40-80 Hz, >130 dB), physical damage >185 dB
- In most cases, these effects are not relevant to transportation noise

Documented Psychological Effects

- Annoyance
- Sleep disturbance
- Stress (and stress-related illness)
- Learning disabilities

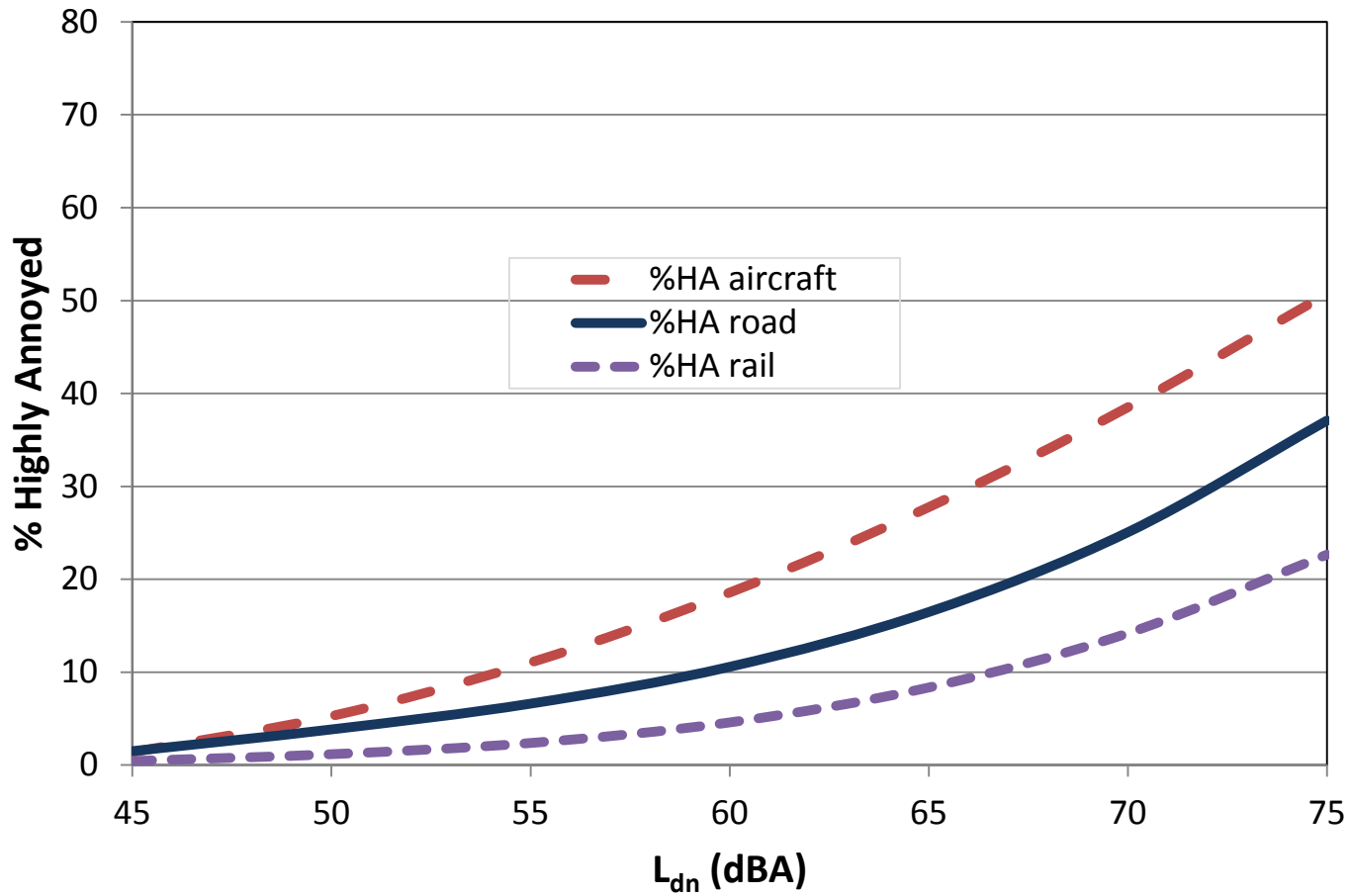
Annoyance Research

- Community reaction ratings (EPA 1974, FICON 1992)

L_{dn}	Community Reaction
≥ 75	Very severe
70	Severe
65	Significant
60	Moderate to slight
≤ 55	

- %HA dose-response curves
 - Schultz (1978) through Miedema & Oudshoorn (2001), FAA study currently being performed

Dose-response curves

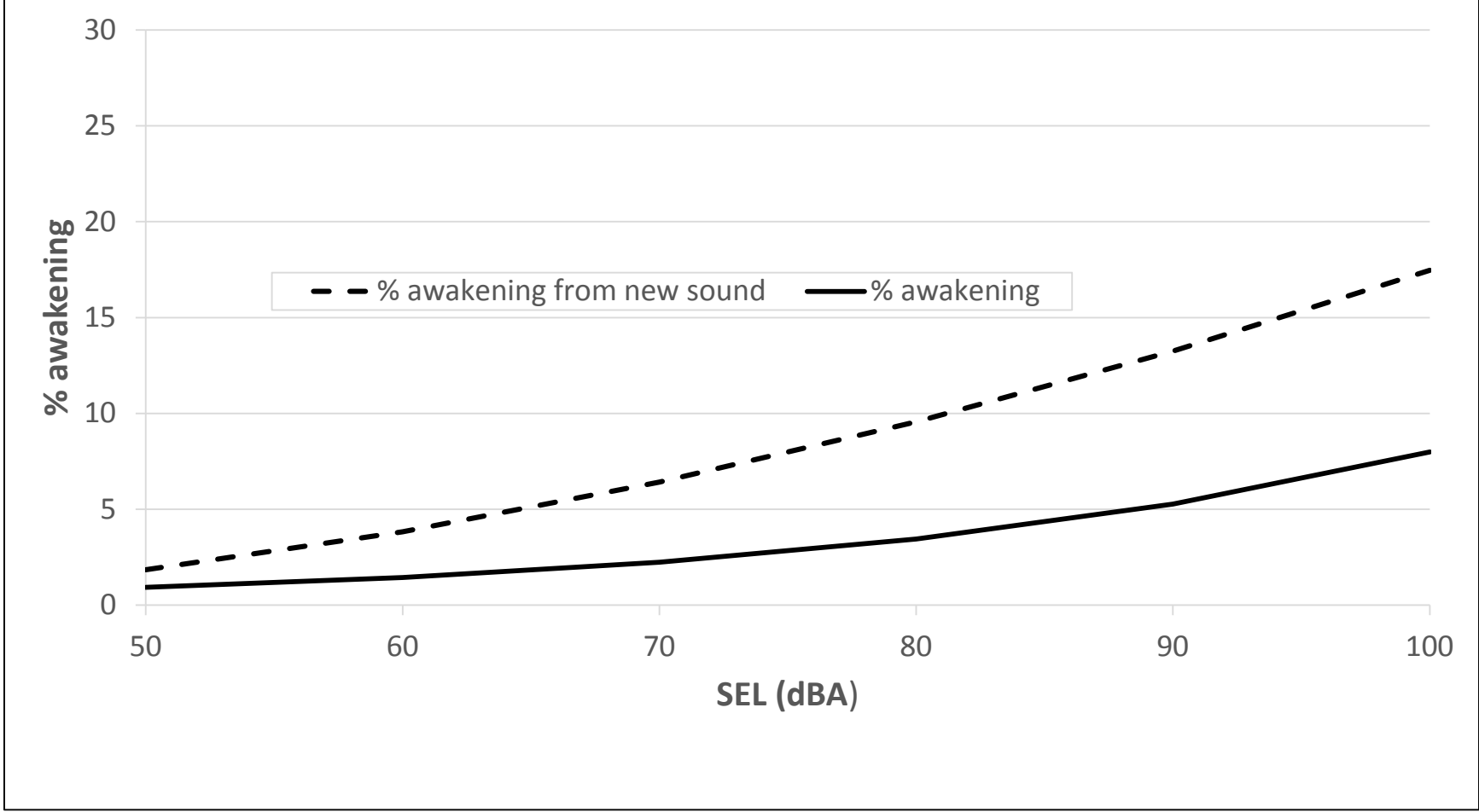


Source: Miedema and Oudshoorn 2001

Sleep Disturbance Research

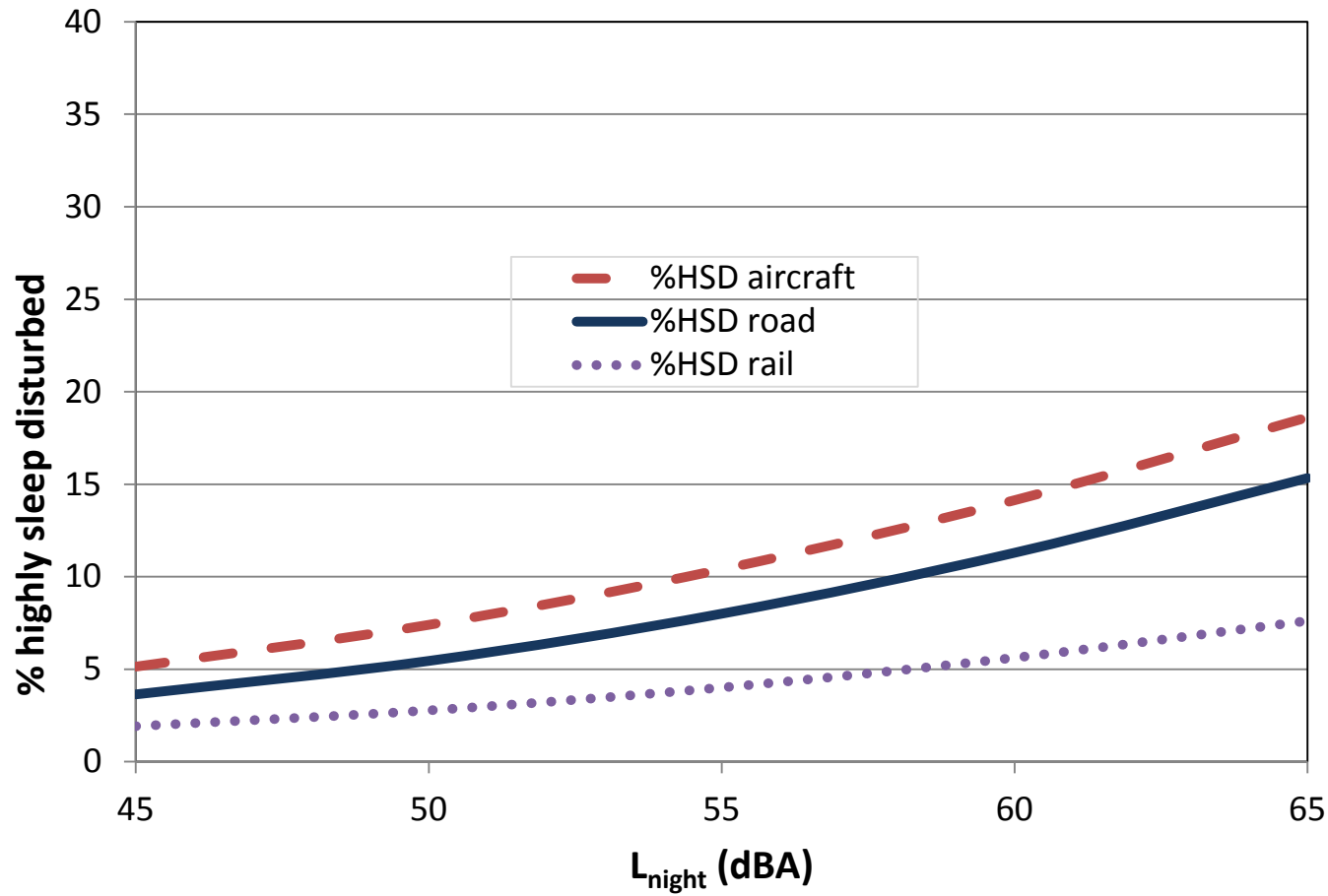
- Must distinguish between internal (e.g., anxiety) and external (e.g., noise) causes
- % awakenings curves
- % sleep disturbed curves

Awakenings dose-response curves



Source: ANSI 12.9-2008

Sleep disturbed dose-response



Source: Miedema et. al. 2002

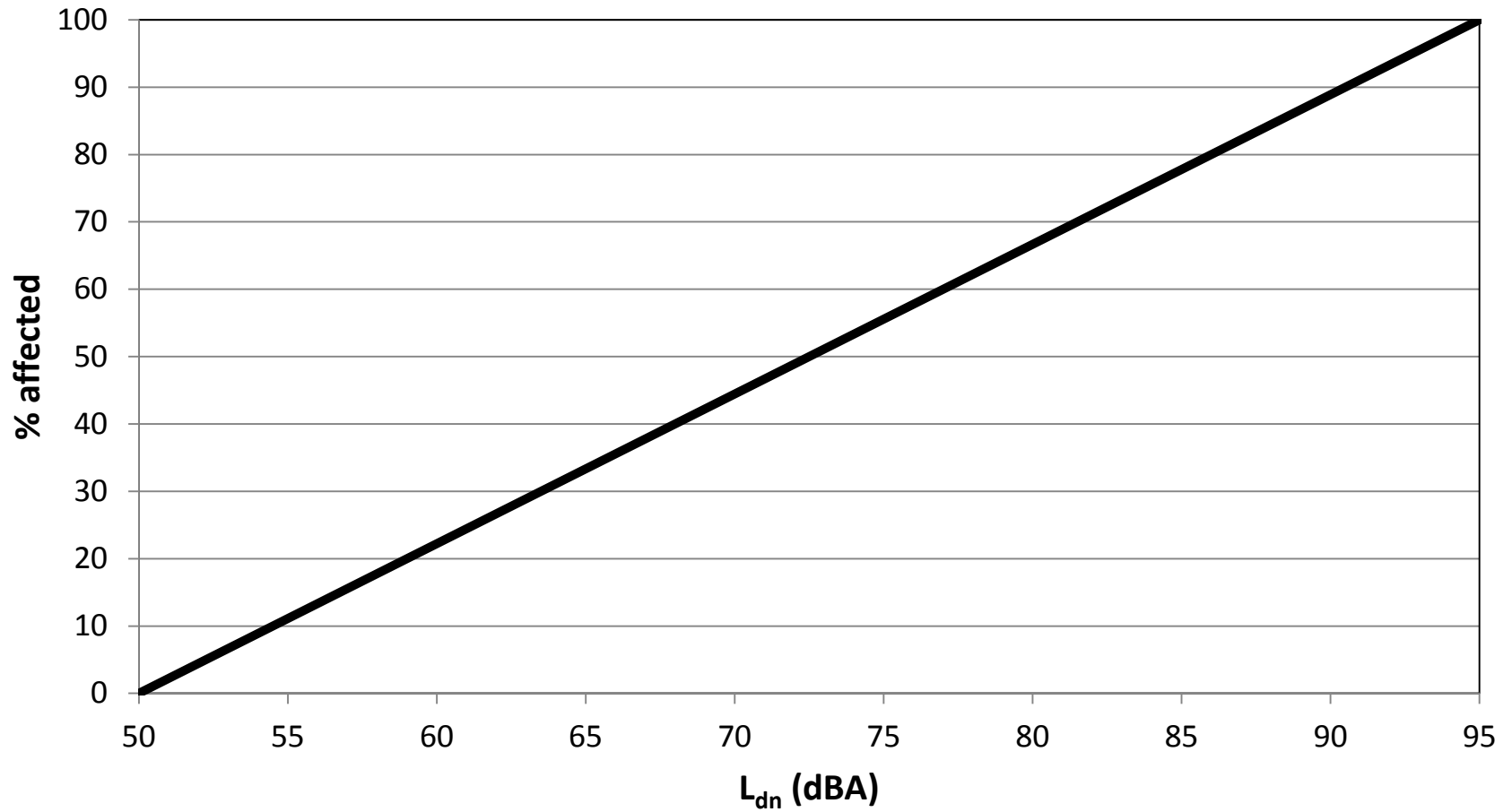
Stress Effects Research

- Endocrine system imbalance
 - Cortisol, other hormones
- Mental health
- Aggression/anxiety

Learning Disabilities Research

- Reading comprehension
- Memory
- Standardized tests

Cognitive effects



Source: WHO 2011

Public Concerns

- All of the above
- New(?) concern is LFN/infrasound
 - Potential health effects
 - dBA not appropriate for LFN/infrasound rating
- Key is referencing credible research
 - Brown noise vs. brown note
 - Sensitivities are variable

References

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