

Non Occupational Noise - Sources, Exposure, and Effects on Hearing

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We need hearing for

- Communication
- Work
- Recognising important sounds
- Enjoyment, entertainment
- Experience of silence



Noise increases continuously

- Reasons
 - Traffic growth, industrialisation
 - Technical development
- Contribution of:
 - Economical well being
 - More spare time
 - Variation of activities
 - Modern people eager to have experiences



Effect of Noise

Concentration, motivation,
learning, language development

Communication
difficulties,
social isolation

Effects on personality and
behavior

Voice problems

Irritation, annoyance,
effects on sleep,
headache,
stress responses

Hyperacusia

Effects on Hearing,
TTS, tinnitus,
Sound distortion

Increase of heart rate,
blood pressure,
hormone responses



Risk for accidents

Why evaluation of noise exposure is important?

- Development of NIHL is gradual
 - Longitudinal and non-reversible process
 - Harmful effects of noise is often too late noticed
 - Tinnitus effects more and more on quality of life
 - Effects on individuals life, social environment and activities
- Need for communication is important
 - Speaking the most significant way to communicate (fast, effectiveness)
 - Many jobs have changed to communication work & good hearing is needed
- Occupational noise exposure continuously problem
 - Diagnosed NIHL about 1000/year In Finland
- On safety more and more important



Why evaluation of leisure time noise exposure is important?

- Noise exposure starts early at childhood
- The total noise exposure of all the leisure time activities combined is less known
- Noisy leisure time may have effect on total noise exposure
 - Appearance of Occupational NIHL faster
 - Hearing loss or tinnitus can interfere the work or or even prohibit the work (e.g. musicians, acousticians)
 - Also the vocational selection (need for good hearing capacity)
- Good health important value of life
- Ignorance of effect of noise is general

Leisure time noise?

= Any high sound level performed during the leisure time activities. Examples of sources:

▫ Music

- Discos, pubs, restaurants , concerts, festivals
- Listening: audio systems (car, home), portable equipment: Mp3, I-pod
- Playing: practising, performing, band/orchestra



▫ Home tools, and equipment indoors and outdoors

▫ Sports

- Sports games, (often strong music included)
- Shooting, hunting
- Motor sports: driving, games, events



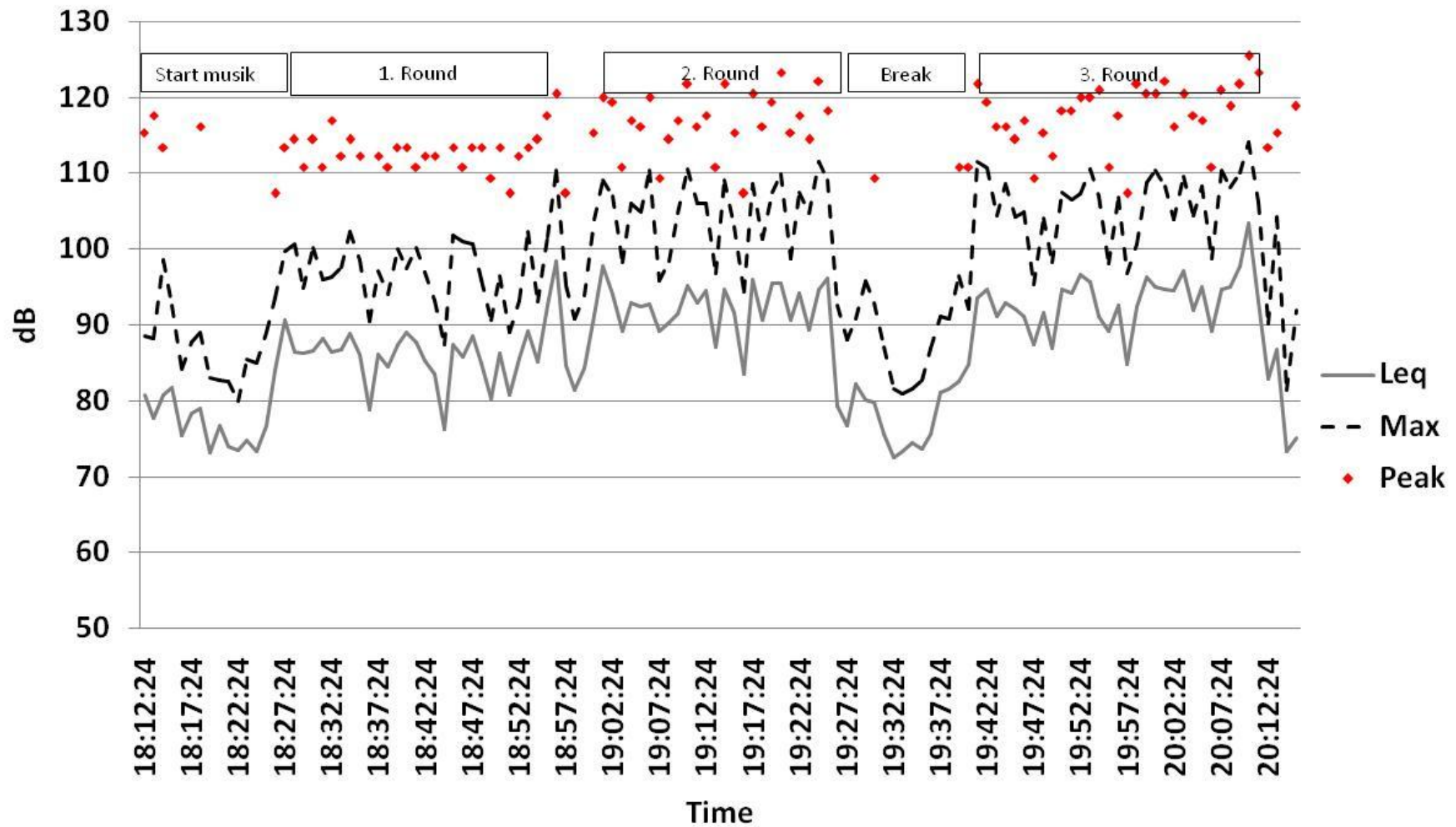
▫ Fireworks, toys, games, movies

Noise levels of different activities , L_{Aeq} , dB



- Playing in a band/orchestra 75-135
- Musical instruments 60-122
- Singing 75-105
- Listening to home stereos 70-100
- Listening via car audio systems 65-100
- Portable music equipment (Mp3) 50-120
- Concerts, festivals, music events 73-110
- Aerobics 78-106
- Movies 70-85
- Discos, music bars 60-110
- Motor sports 70-115
- Shooting (hunting) 120-165 L_{peak}
- Fireworks 120-165 L_{peak}
- Machines and equipment at home 60-100
- Tools, and machines outdoors 70-110
- Toys, games 70-112

Volley Ball game Finland 2010, $L_{Aeq}=92$ dB



Toys can also be noisy

Toy weapons (impulse noise)	132-170
Toy weapons (continuous noise)	82-99
Cars, other moving vehicles	80-102
Toy tools	94-109
Phones, mobile phones	82-94
Simulators	81-100
Games	81-104
Soft toys	81-100
Bicycle horns	92-112
Key chains	73-80



Study gives the answers

What is the Finnish people's total risk for hearing loss related to leisure time noise exposure during the lifetime?

- How much time is spend weekly on leisure time activities?
- What are those activities, which have most effect on total leisure time noise exposure?
- What is the total leisure time noise exposure of all the activities combined?

What are the effects of personal noise exposure on self-reported auditory symptoms?

What are the thresholds of Finnish conscripts before and after the military service?

How the noise exposure was calculated and evaluated?

- According to Occupational noise exposure legislation
 - EU directive 10, 2003 (National legislation VnA 85,2006)
 - Lower and upper action levels 80 dB, 85 dB, (limit value 87 dB)
 - Was calculated with weekly noise exposure according to ($L_{Aeq,40h}$), ISO 1999
- With Questionnaire
 - Self reported duration of exposure of activity (hours)
 - Subjective estimation of loudness Scale 1-5 (60-100 dB)
 - Hearing Symptoms
 - Audiograms (conscripts)



Study co-operation

- The Finnish Federation of Hard of Hearing (FFHOH)
- National Institute for Health and Welfare (THL) part of the EXPOLIS-study
- The Finnish Defence Forces (Porin Prikaati, SOTLK)



NATIONAL INSTITUTE
FOR HEALTH AND WELFARE



Puolustusvoimat

Försvarsmakten | The Finnish Defence Forces

Study subjects

- Teenagers 12-16 years
- Conscripts 19-27 years
 - Pori Brigade
 - Arrive and leaving examination
- Adults 25-55 years
 - Helsinki area
 - EXPOLIS-study

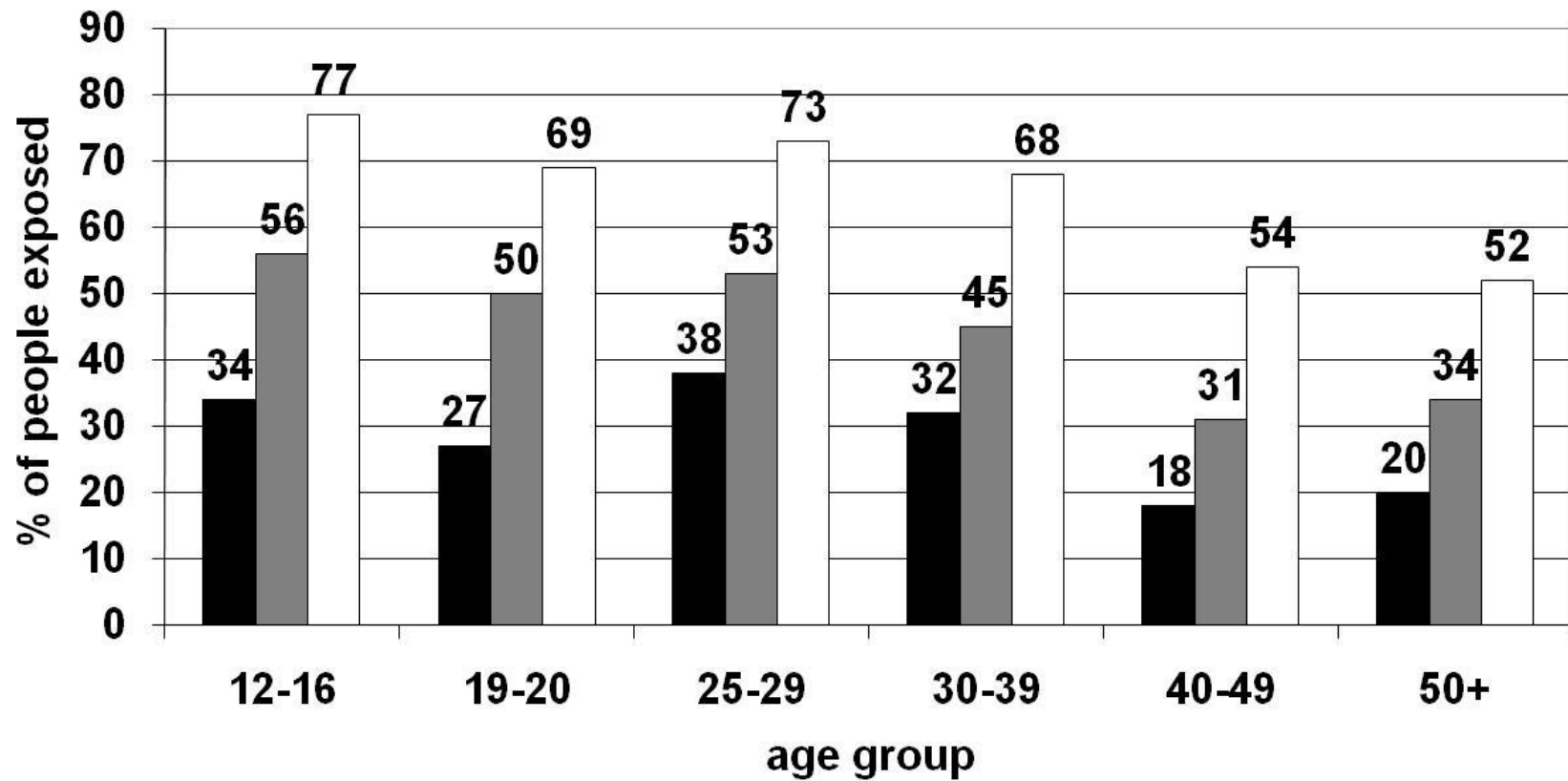
Results 1

- One of five was exposed over 85 dB leisure time noise at their life time
 - Teenagers and young adults used 40-hrs/week at their noisy leisure time, adults about n. 25-30 hrs/week
 - Weekly noise exposure was gathered many activities, the most significant were:
 - Music bars & discos, concerts, shooting, playing in a band, home tools and motor sports
- Safety level for ears, under 75 dB
 - 20% of teenagers
 - 30% of 19-40 years olds
 - About half of over 40- year olds



Weekly noise exposure among all age groups

■ weekly noise exposure over 85 dB ■ weekly noise exposure over 80 dB
□ weekly noise exposure over 75 dB



Results 2

- Tinnitus sometimes or often
 - Over 70% of teenagers and conscripts
 - 25 % of adults
- TTS sometimes or often
 - About 50 % of teenagers and conscripts
 - Over 10 % of adults

Auditory symptoms experienced especially those with high personal weekly noise exposure.

Weekly noise exposure and hearing symptoms -Conscripts

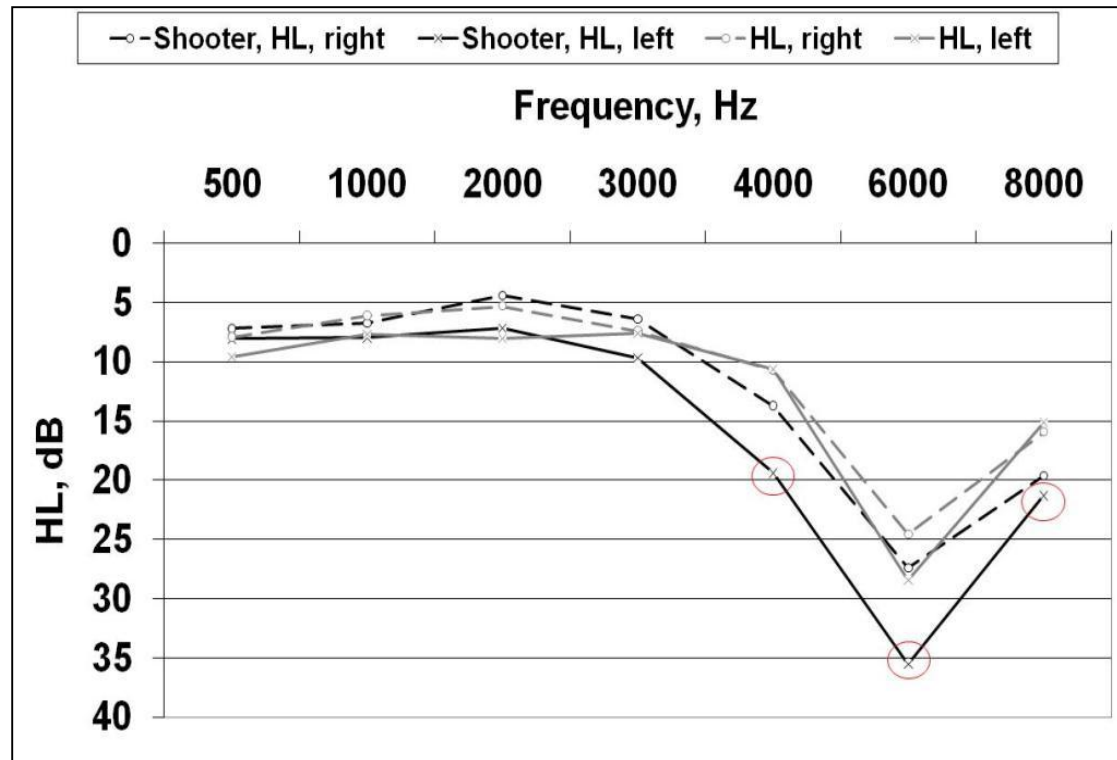
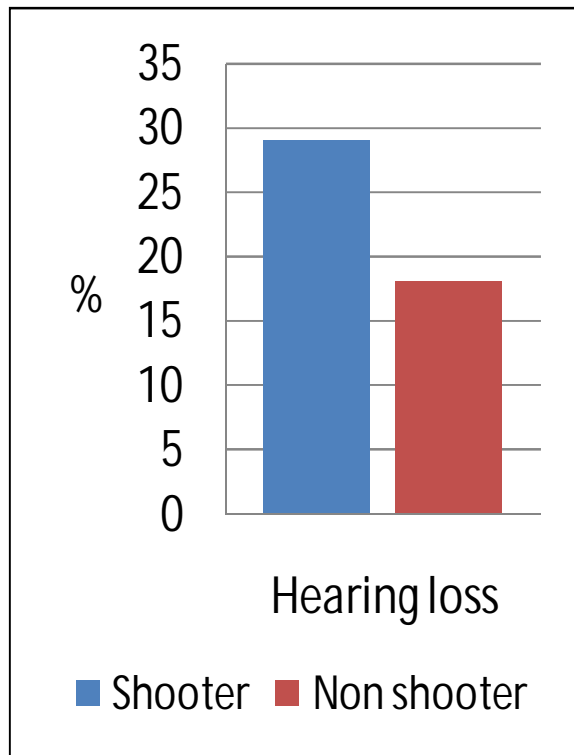
Symptom	Never 0	Sometimes 1	Often 2	Continuously 3	Difference
Tinnitus related to noise	78	80	86	82	All
Tinnitus for other reason	79	81	84	87	All
Pain in ear	79	80	85	-	-
Sound unpleasent	79	80	83	92	All
Sound distortion	79	81	85	93	All
TTS	78	81	84	95	All

Results 3

- 19% conscripts hearing loss BEFORE the military service
 - Most of them related to leisure time noise
- 27% had hearing loss at the END OF SERVICE of
 - The most effect was with less hearing protection usage rate of combat training in field

Hearing of Shooters

-conscripts



Conclusions

- The most sound exposure period seem last about 15-20 years
 - at most at the age of 25-30 years, decrease after 40 years
- Risk of hearing loss
 - 1 of 3 of teenagers and young adults (under 40 years)
 - 1 of 5 adults (over 40 years)
- A lot of time is used on noisy leisure time activities
- 1 of 5 hearing loss of Conscripts before military service
- 1 of 3 hearing loss of Conscripts after military service
- Shooters had hearing loss already before the military service
- Auditory symptoms general, especially tinnitus & TTS signals with high exposed noise levels
- Hearing protection hardly use



What should be done?

Noise levels must be reduced!!

- Legislation, especially with children hearing protection!
- Noise control (authorities, event arrangers)
 - Measurements, checking
 - Noise reduction
 - Technical opportunities (e.g. limiters)
 - Planning, design (acoustical & audio planning)
- Health examinations
 - Audiograms, hearing symptoms questionnaires
- Education
 - Into schools education systems
 - Key professionals: teachers, trainers, designers etc.
- General education
 - Hearing conservation programs, Campaigns
- Hearing protectors
 - Nice looking,
->To trend.. Losers do not used HPD's!!!



Thank you!



**THE MOST IMPORTANT THINGS ARE SAID WITH LOW VOLUME
LEVEL!**