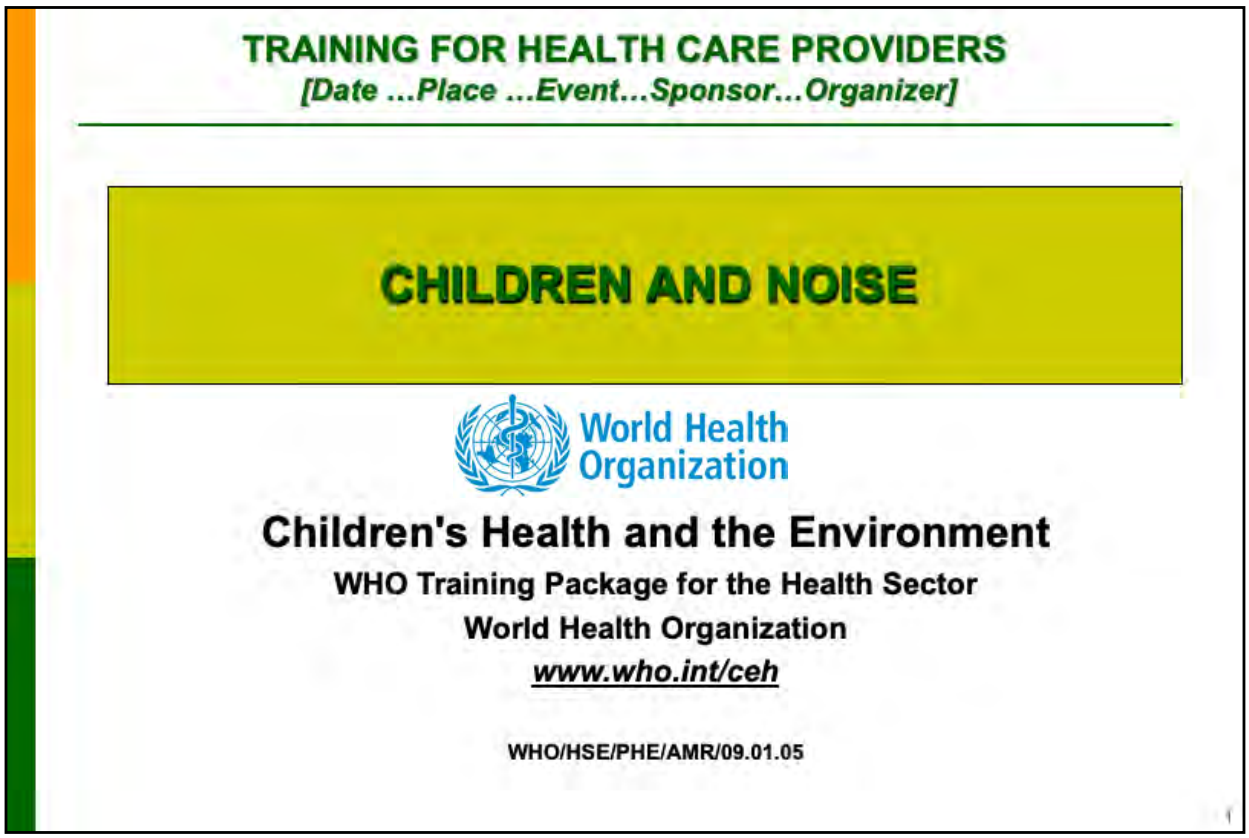
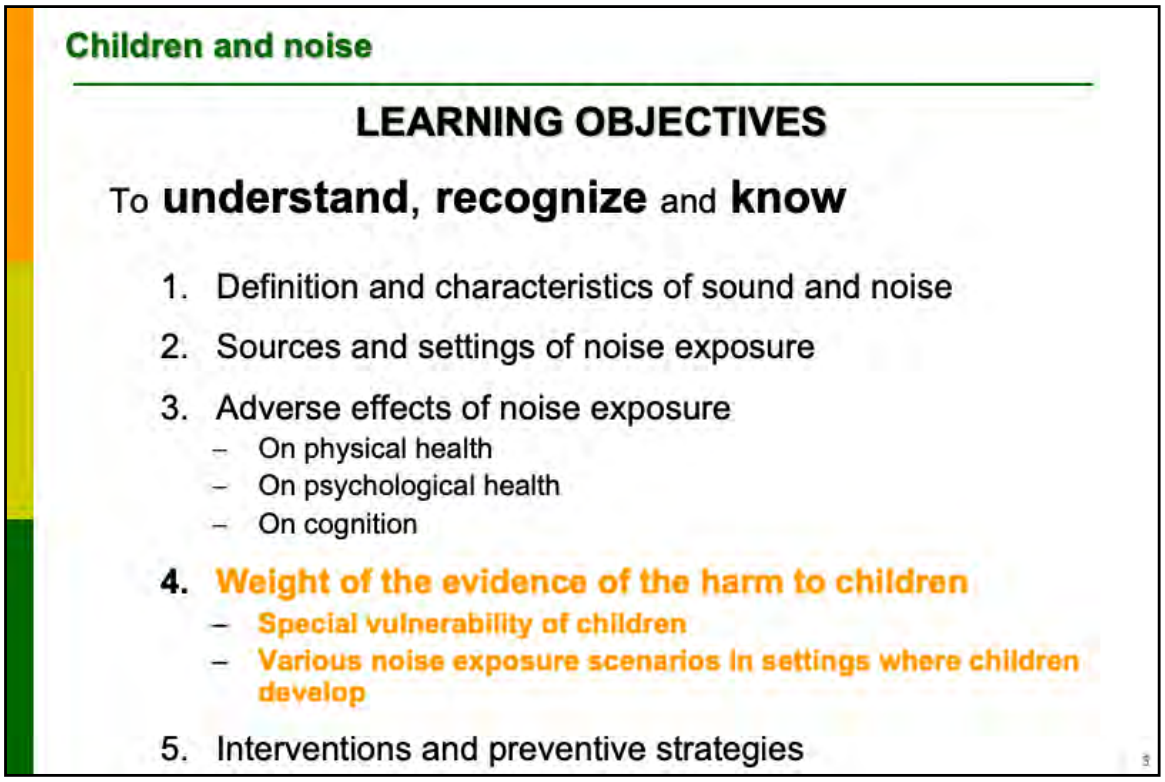



**<<NOTE TO USER: Please add details of the date, time, place and sponsorship of the meeting for which you are using this presentation in the space indicated.>>**

This presentation on Children and Noise is part of a comprehensive set of training materials for health care providers on children, the environment and health.

**<<NOTE TO USER: This is a large set of slides from which the presenter should select the most relevant ones to use in a specific presentation. These slides cover many facets of the problem. Present only those slides that apply most directly to the local situation in the region. It is also very useful if you present regional/local examples of noise prevention programs, if available, and choose local relevant pictures.>>**

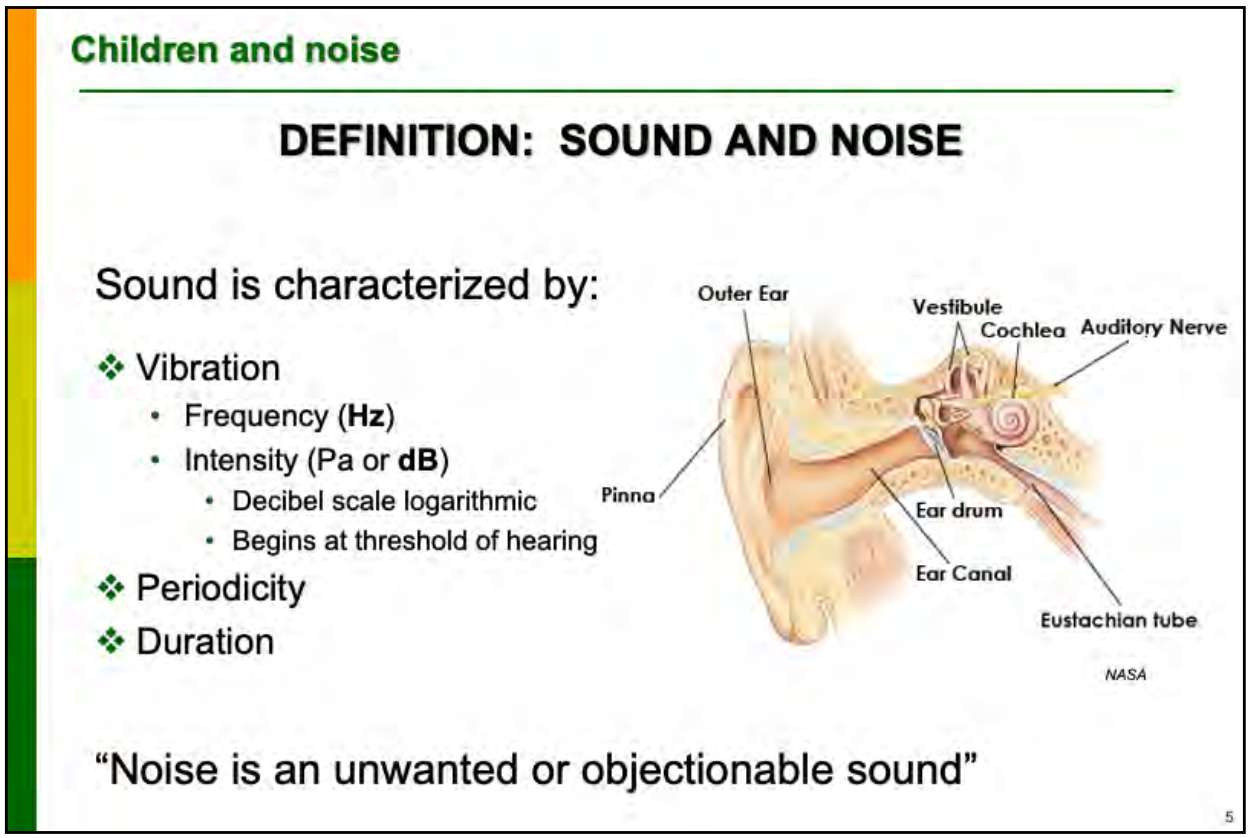
## CONTENTS




These are the learning objectives for this module. After the presentation, the audience should understand, recognize and know

<<READ SLIDE>>

## CONTENTS




**What is sound?** Sound is a mechanic vibration propagated by elastic media (as air and water) which alters the pressure displacing the particles, and can be recognized by a person or an instrument.

Vibration and noise can never be separated but vibration can exist without audible noise.

Sound is characterized by its intrinsic characteristics:

•**Vibration:** Sound is a mechanic vibration, expressed as a combination of pressure (Pascals, Pa) and frequency (Hertz, Hz)

- •**Frequency** or pitch is the number of cycles per second (Hertz, Hz or kilo Hertz, KHz).
- •**Intensity** or loudness is the "level of sonorous pressure" and is measured in Pascals (Pa) or decibels (dB). The audible spectrum of the human ear is between 0.00002 Pa (corresponds to 0 dB) and 20 Pa (corresponds to 120 dB). The intensity of human speech is approximately 50 dB. Decibels are used for convenience to express sound on a compressed, logarithmic scale in the human audible spectrum.

•**Periodicity:** describes the pattern of repetition of a sound within a period of time: short sounds that are repeated.

•**Duration**: is the acoustic sense developed by the continuity of a sound in a period of time, for example music, voice or machinery.

**What is noise?** Noise is an unwanted or objectionable sound. Generally, the acoustic signals that produce a pleasant sense (music, bells) are recognized as "sound" and the unpleasant sounds as "noise" (for example: produced by a machine or airplane). It can be a pollutant and environmental stressor, and the meaning of sound is important in determining reaction of different individuals to the same sound. One person's music is another's noise.

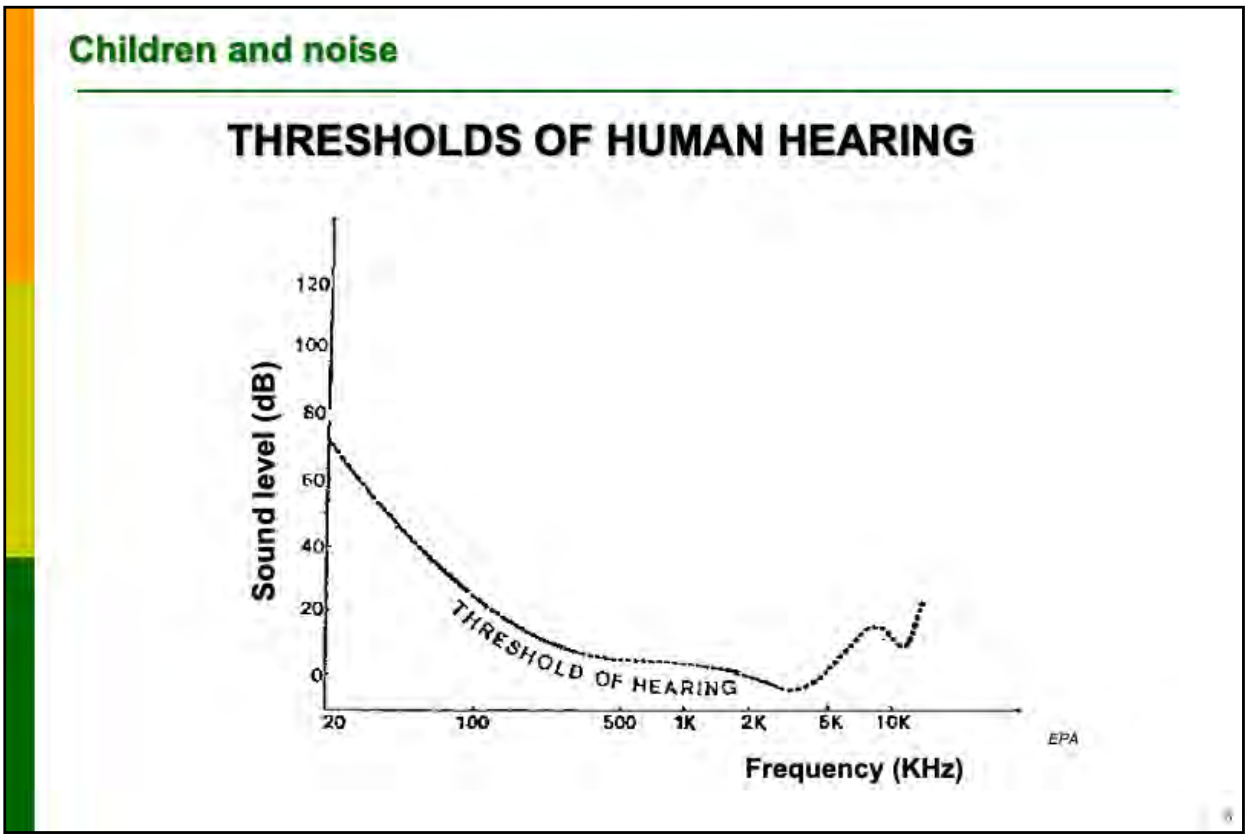
The human ear is an instrument that detects vibration within a set range of frequencies. Air, liquid or solid propagates vibration; without them, sound does not exist. Sound does not exist in the vacuum. The higher the level of pressure of the sonorous wave, the shorter the period of time needed to be perceived by the ear.

**Why are not all vibrations audible?**

The ear is a frequency analyzer. The eardrum separates tone and conduction in two different ways: by the nervous system and by the bones. The nervous system connects the cochlea to the temporal region of both hemispheres of the brain. The cochlea perceives vibration transmitted directly from the bones of the head.

*Picture:*

•*NASA*




**Why is noise sometimes inaudible?**

Threshold of hearing is defined as the minimum efficient sonorous pressure (Pa or dB) that can be heard without background noise of a pure tone at a specific frequency (Hz or KHz, cycles per second).

The human audible frequency range is from 20 to 20.000 Hertz (Hz). Frequencies out of this range are not detected by the human ear. The ear is not equally sensitive to all the frequencies.* The most audible frequencies are between 2000 and 3000 Hz (range within which the least pressure is needed to provoke the conscious recognition of a sound). This range can be easily identified where the curve is at its minimum and corresponds to human speaking frequencies.

For this reason, sound meters are usually fitted with a filter whose response to frequency is a bit like that of the human ear. The most widely used sound level filter is the A scale, which roughly corresponds to the inverse of the 40 dB (at 1 kHz) equal-loudness curve. Using this filter, the sound level meter is thus less sensitive to very high and very low frequencies. Measurements made on this scale are expressed as **dBA**.

**The "normal threshold" of hearing is defined in "young people with a healthy auditory system".**

The **"pain threshold"** is the high level (high dB) audible sound where the level of pressure of the sound produces discomfort or pain. The pressures of the sounds are over the curve: "ultrasounds". Very powerful levels of sound can be perceived by the human ear but cause discomfort and pain.

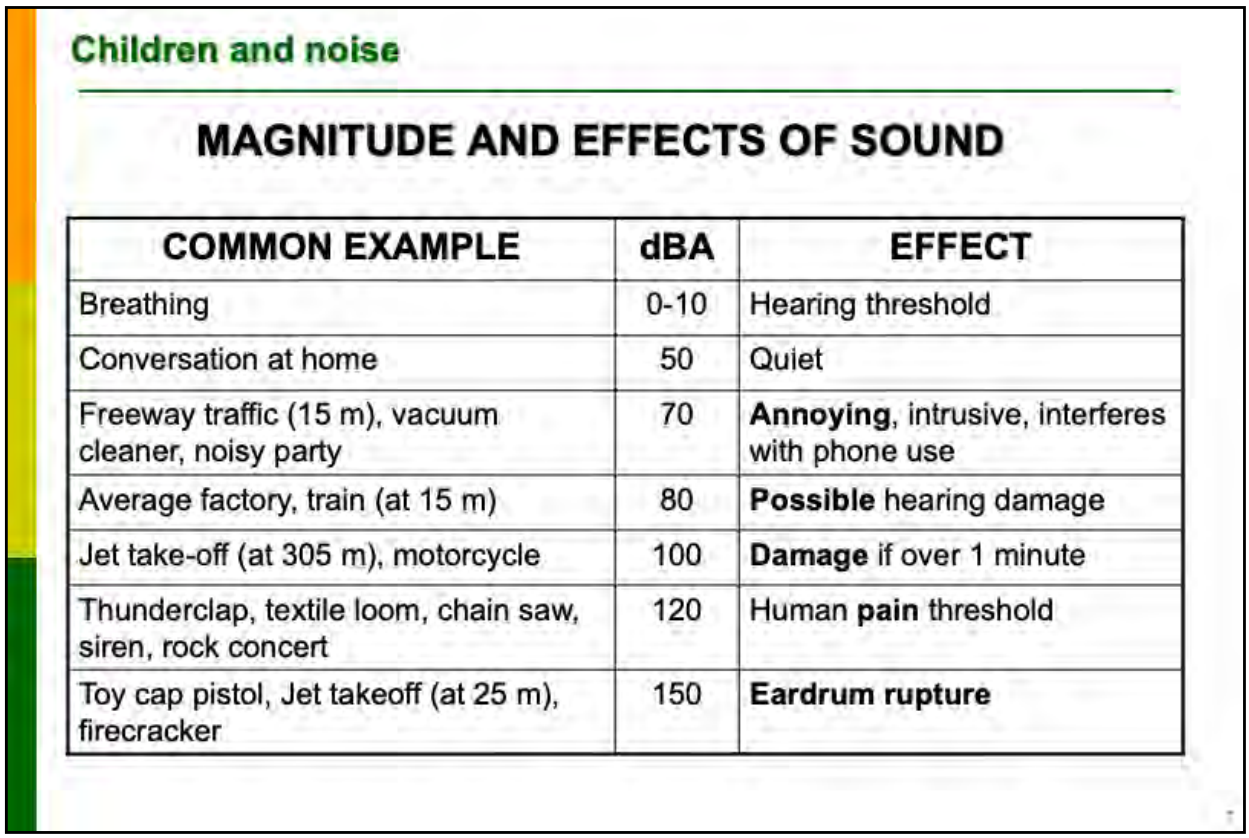
*Pressures below the audible level are called "infra-sounds": the pressure is detected but our hearing mechanism is not adapted to making the sound evident to the human ear (under the curve in the graphic). These frequencies (less than 20 Hz, not audible for the human ear) can be produced by machines or "ultrasonic" motors of planes. Out of the limits of the human threshold of hearing exists sound that can be perceived by special equipment or animals such as dolphins and bats that are equipped to perceive sound that humans can not perceive. The human being hears a very short portion of the existing sounds, the very weak and the ones above and below of the thresholds are not perceived or they are accompanied by pain, ***and can produce damage to a system that is not prepared to perceive them as the person may not be able to protect her/himself from this deleterious exposure***. There is individual variation within these general parameters.

*Reference:*

•Noise effects handbook, National Association of Noise Control Officials. *Office of the Scientific Assistant, Office of Noise Abatement and Control, U.S. Environmental Protection Agency*, 1979, revised 1981 (www.nonoise.org/library/handbook/handbook.htm).

*Picture*:

•*EPA (U.S. Environmental Protection Agency)*




This abbreviated table correlates common sounds with effects on hearing.

Additional examples for discussion are listed below:

| | | |
|---|---|---|
| -Quiet suburb or quiet conversation | 50 dB A | No significant effect |
| -Conversation in a busy place, background music or traffic | 60 dB A | Intrusive |
| -Freeway traffic at 15 metres | 70 dB A | Annoying |
| -Average factory, train at 15 metres | 80 dB A | Possible hearing damage |
| -Busy urban street, diesel truck | 90 dB A | Chronic hearing damage if exposure over 8 hours |
| -Subway noise | 90 dB A | Chronic hearing damage, speech interfering |
| -Jet take-off 300 metres | 100 dB A | More severe than above |
| -Stereo held close ear | 110 dB A | More severe than above |
| -Live rock music, jet take off 160 mts | 120 dB A | As above, human pain threshold |