

Types of prevention

Risk assessment

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Health

- A state of complete physical, mental and social well-being and not merely the absence of disease or infirmity (WHO, 1948).
- Health is neither born nor cultivated in hospitals but it arises and develops wherever people live, play and work, relax and grow old.
- Pillars of health care:
 1. Health education
 2. Disease prevention
 3. Health protection + health promotion

Health protection and promotion

- **Health protection:** summary of activities and measures focused on creation and protection healthy living and working conditions aimed at the prevention of infectious and non-infectious diseases
- **Health promotion:** summary of activities helping people to strengthen and improve their health and control their determinants of disease
- Sectors involved: health care, environmental sciences , food production and agriculture, technologies, industry, trade, social care, transport, culture, state defense forces, schools, sport facilities...

Some examples of prevention:

- Water treatment technologies
- Indoor air quality (lecture rooms, study rooms, entertainment halls, hospital rooms etc.)
- Food production technologies
- Product design and product safety (noise, chemical safety etc.)
- Product claims (false claims about able to cure serious illnesses such as generalized cancer, marketing of breast milk substitutes etc.)

Prevention

Type of prevention	Tasks	Responsibility
Primary	Influencing disease determinants and reducing health risks	Health and Social care services, Environment. sci., , Food prod. & Agriculture, Education etc.
Secondary	Preventive examinations, screening programs	Health care services
Tertiary	Treatment of diseases and mitigation of their consequences	Health and social care services, M. of Social Affairs
Quarterly	Mitigate the effects of unnecessary or excessive treatment interventions	Health care services

Selected campaigns of WHO

- *BreatheLife* mobilizes cities and individuals to protect people's and Planet health from the effect of air pollution.
- Predominant type of prevention: primary

AIR POLLUTION ISSUE GLOBALLY

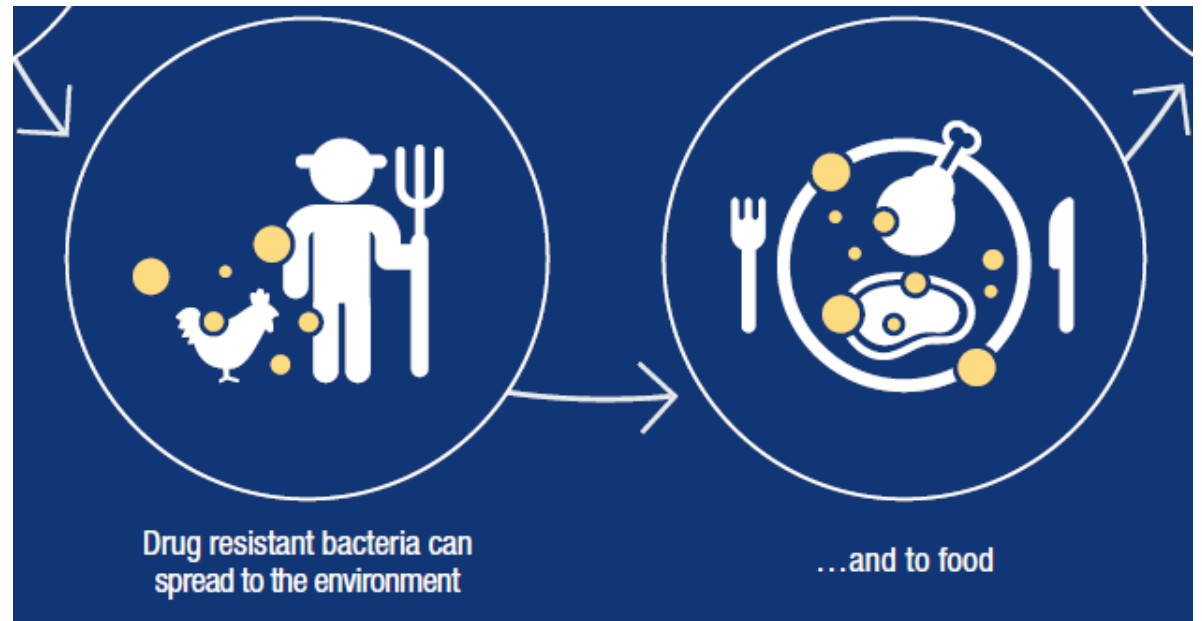
Over 80% of the world's cities have air pollution levels over the WHO guideline for safe air



LEARN MORE AT: [BREATHELIFE2030.COM](https://www.breathelife2030.com)

Selected campaigns of WHO

- Antibiotic resistance: new WHO recommendations are trying to help maintaining the effectiveness of antibiotics used in human medicine by limiting the unnecessary use in animals.
- Predominant type of prevention: primary & tertiary



Selected campaigns of WHO

- „*Global Hearts*“ is an initiative to averting the global threat of cardiovascular disease, the world's leading causes of death.
- Predominant type of prevention: primary & secondary



Selected campaigns of WHO

- "*WHO's Global School Health Initiative*", also known as "*Health Promotion School*": An initiative to promote health and education at local, national, regional and global level. The aim is to improve the health of students, school staff, families and other community members through schools.
- Predominant type of prevention: primary



Selected campaigns of WHO

- Global Action Plan
„Healthy enterprise“
addresses all aspects of workers' health: primary prevention of occupational hazards, protection and promotion of health at work, working conditions and health services for employees of enterprises.
- Predominant type of prevention: primary

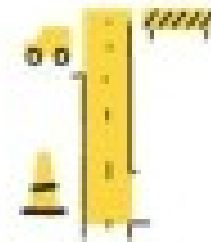


Selected campaigns of WHO

- *SaveLIVES*: road safety package, evidence-based inventory focusing on speed limits, transport infrastructure, vehicle safety, traffic law and regulations and actions increasing the chance of survival after a traffic accident.
- Predominant type of prevention: primary



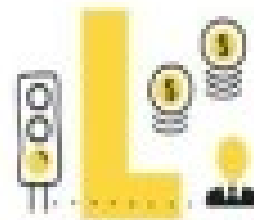
Speed management



Infrastructure design and improvement



Enforcement of traffic laws



Leadership on road safety



Vehicle safety standards



Survival after a crash

The preventive
and
therapeutic
components of
medicine are
complementar
y to one
another.



“What fits your busy schedule better, exercising one hour a day or being dead 24 hours a day?”

Why to prevent diseases when we can cure them?

- Effective prevention reduces the incidence and prevalence of serious diseases.
- In most cases, treatment has side effects that can be avoided by effective prevention.
- Consistently healthy people are economically active.
- Consistently healthy people are less sensitive to social, cultural and other differentiation.
- Satisfactory environment fulfills well the functions of production, recreation and regeneration.
- *The zero option means the growing cost of medical technology, the possibilities of which can be (once) exhausted (eg. antibiotics and current resistance, organ transplants and ethical issues etc.).*

Health risks assessment



Hazard vs Risk

- Hazard

- Characterizes properties of agents
 - Pathogenicity, toxicity...



... It may, it could...

- Risk

- chance of harmful effects to health
- It is a mathematical function of hazard.
 - $P = 0 \dots 1$
 - $P = 0 \% \dots 100 \%$

Pifalls in risk assessment

- Risk assessment (among others) = hazard analysis + emotions
 - the public knows very little about probability and overestimates its importance
 - experts (mostly) know very little about emotions; experts must be fully aware of the fact, that
 - emotions are measurable, as well as the probability is
 - emotions can be affected as well as the probability
 - emotions are a legitimate part of the risk

Prioritization of health risks

- Why?

There are a lot of risks that occur in the human environment, but only some of them have a direct impact on human health.



Risk Assessment

Attention focuses on human!

Hazard identification: can the agent (*specific active factor*) harm health?

1. Dose – response relationship: what is the numerical relationship between the exposure and the effect on health?
2. Exposure assessment: how important is the contact of the individual / population with the agent?
3. Risk characterization: can the assumption of an adverse effect on health be confirmed?

Types of hazard (will be discussed in more detail in specific seminars)

- Biological agents
 - Pathogenic microorganisms (*see epidemiological seminars*)
 - Non-pathogenic microorganisms related to health
 - Toxins as by-products of decomposing and primarily non-pathogenic microflora (fungi and aflatoxins)
- Chemicals
 - Irritating, toxic, mutagenic, teratogenic and carcinogenic effects
- Physical factors
 - Noise, vibration
 - Nonionizing and ionizing radiation: Special features of therapeutic use: benefit / risk ratio
 - Microclimate, unilateral strain of muscle groups

Types of dose-response relationship

- Agents with deterministic health effect: depends on dose
 - Usually at infection known as the minimal infective dose
 - Many of chemical substances
 - High dose of ionizing radiation
- Agents with stochastic health effect: depends on a chance; one illness/death per one thousand people, per one million people, per ten million people?
 - Chemicals with carcinogenic or teratogenic effects
 - Low dose of radiation
- However: dose in environment is not equal to dose in tissues (see next slide)

Exposure assessment

- Potential dose
 - It corresponds to the concentration of the agent in the environment (i. e. in air, water, food, soil), converted to a unit of mass, volume or area of the matrix.
- Applied dose
 - It depends on the speed of diffusion and capacity of receptor.
 - Ingestion, inhalation, contact with skin or mucous membranes
 - Comment: besides the concentration, the duration of exposure can also determine the size of the effect.
- Effective dose
 - Defined by the concentration of agents in the target organ
- How to measure the exposure plausible? (see next slides)

Exposure assessment – methods

- Indirect methods
 1. Environmental monitoring: The amount of agent in the matrix multiplied by the average matrix intake by the exposed person:
 - Average lung volume (22 m³/person/day)
 - Average water consumption per person (1,9 liter/day)
 - Amount of food consumed per person (e.g. Food pyramid)
 - The average length of stay in the swimming pool
 - Inaccuracy! Interindividual differences are significant!
 2. Exposure scenario or questionnaire survey: A rough estimation of the exposure can be specified, most often in a well defined population group (typically school pupils, members of the army ...)

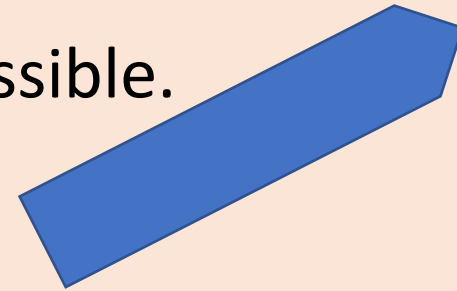
Estimation of individual exposure based on the food pyramid may be difficult.



CLOSE ENOUGH.

Exposure assessment – methods II

- Direct methods
 - are preferred but are generally less accessible.
- Personal monitoring
 - 24 hrs recall, double portion method...
 - Personal dosimetry - healthcare workers
- Biological monitoring
 - Biomarkers of exposure (DNA adduct in tests of genotoxicity)
 - Biomarkers of effect (measurable pathophysiological changes in organs)
 - Biomarkers of sensitivity (measurable susceptibility to health impairment)



Risk characterization

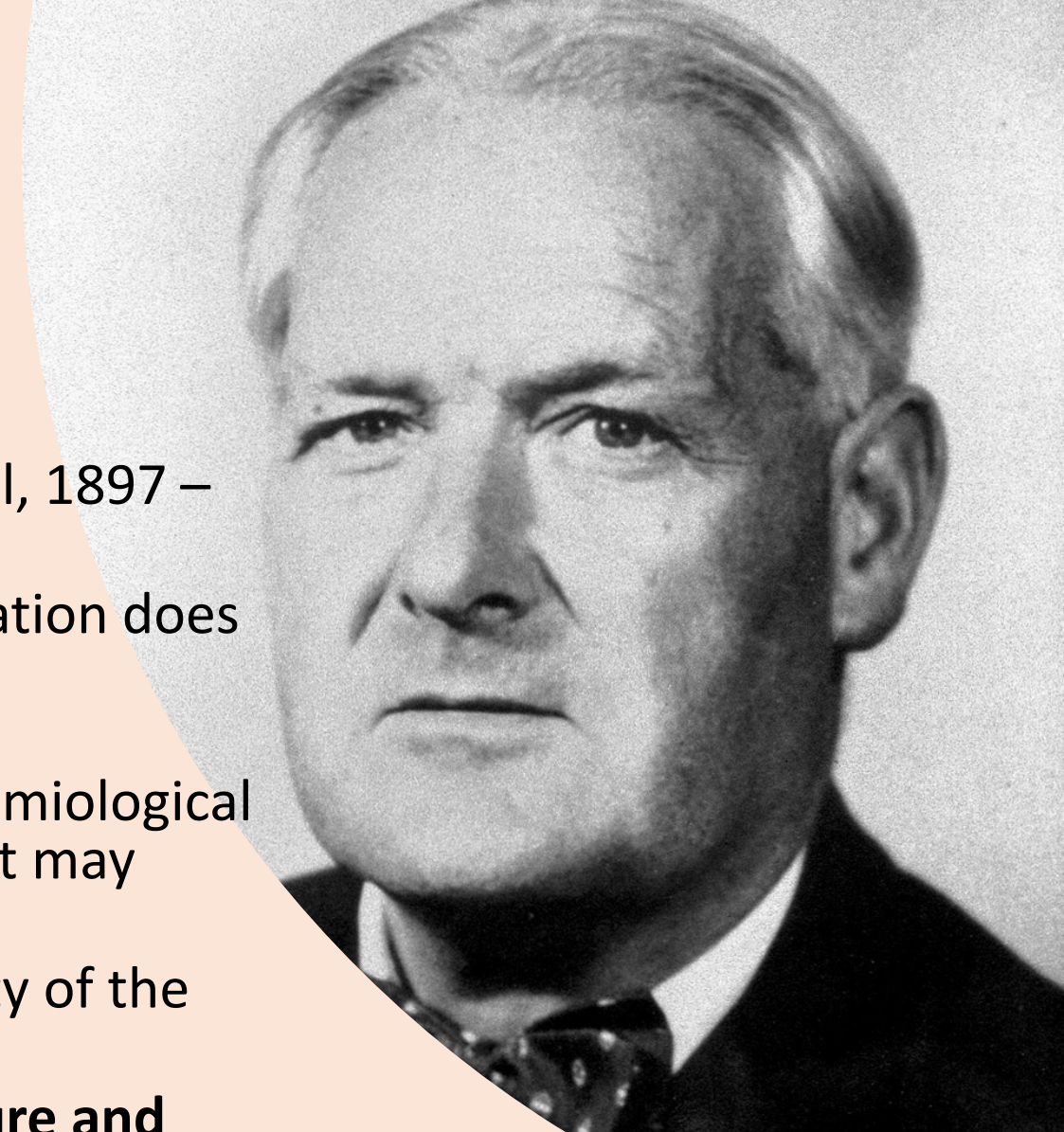
1. Harmful to health has not been confirmed
2. Exposure to harmful factor reduces the level of well-being (health in a broader sense)
 - Example: The source of environmental noise has forced the use of space (more demanding activities are moved to a quieter part of the building).
3. Exposure to a harmful factor poses a threat to health in the longer term, with the factor being considered at most as one of several disease factors (long-term and multifactorial health effects)
4. Exposure to harmful agents poses an immediate threat to human health or lives
 - *(See the Czech “methanol affair” in 2012.)*

Epidemiology (non-infectious)

- Method of work used to study the distribution of determinants of diseases in the population.
 - *Epi demios (Greek) = Among the people*
- Descriptive, analytical, experimental and interventional epidemiology use statistical methods; a separate field of biostatistics is being developed.
- The way how to study stochastic health effects

Epidemiology in health risk assessment I.

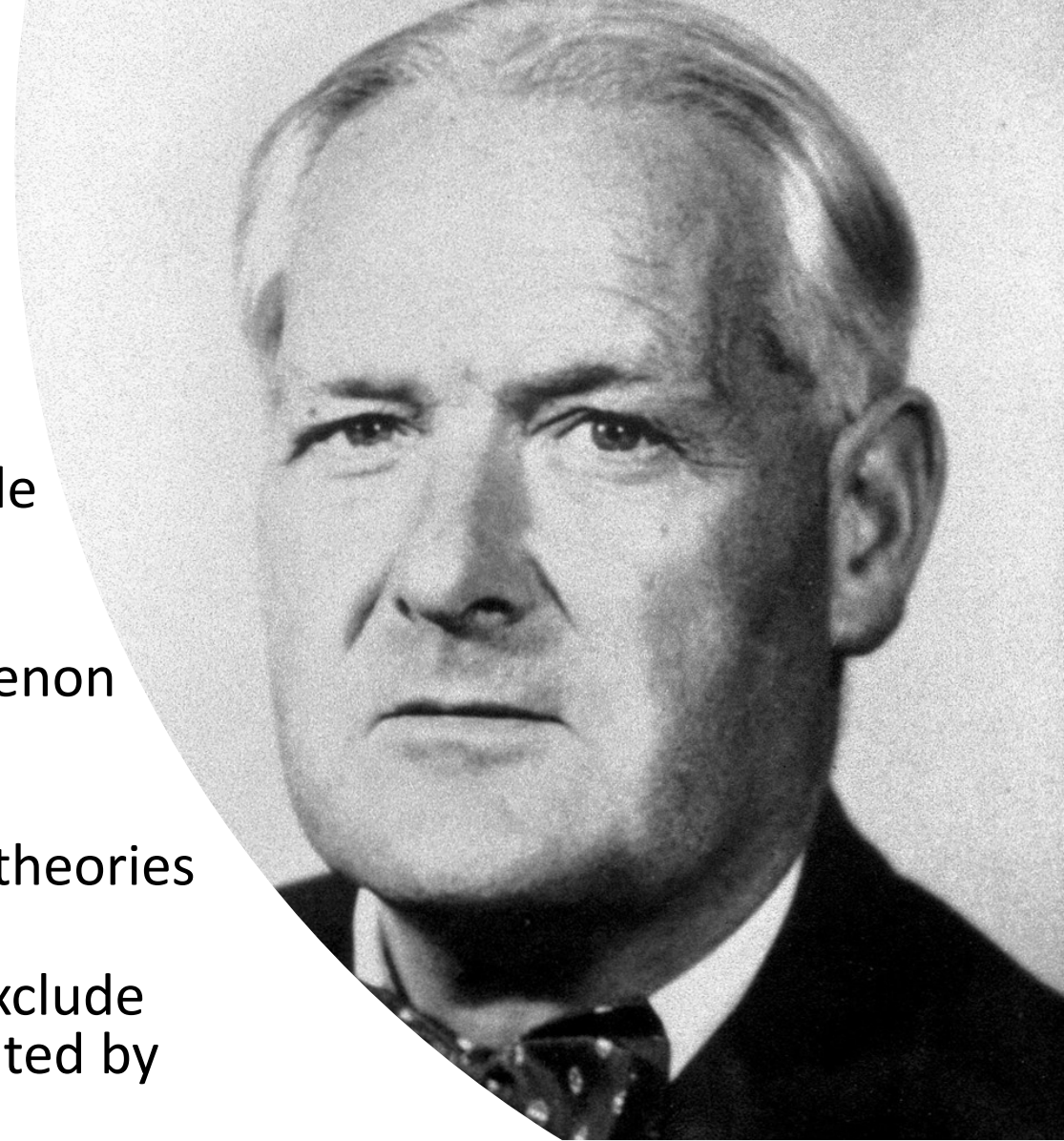
- Problems: transferability of results
- Internal validity of epidemiological studies
- Hill's criteria of causality (Sir Austin Bradford Hill, 1897 – 1991)
 - ✓ Strength of association: Even a weak association does not rule out causality if it is weakened by unrecognized confounders
 - ✓ Consistency: Inconsistency with other epidemiological studies does not exclude causality, the effect may only occur under special circumstances
 - ✓ The causality does not assume the specificity of the effect
 - ✓ **The temporality (time sequence) of exposure and effect is a prerequisite!**



Epidemiology in health risk assessment II.

Hill's criteria of causality *...continuation*

- ✓ Biological gradient: its absence does not exclude causality, many dependencies can be J-shaped
- ✓ Biological plausibility: the inability of pathophysiological explanation of the phenomenon may be just the result of the current scientific knowledge
- ✓ Coherence: Incompatibility with "established" theories does not exclude causality
- ✓ Experimental evidence: its absence does not exclude causality, as the experiment can also be prevented by ethical reasons
- ✓ Analogy: its absence can only be a manifestation of a lack of scientific imagination



Public Health and qualitative research

- Be aware that a state of complete physical, mental and social well-being cannot be expressed by a statistic only! Health is relationship too!
- Qualitative research always just as a complement to epidemiological methods of work It enables us to understand the social, cultural, economic and behavioral aspects of (public) health
- Epidemiological methods: “How many? How much?”
 - ✓ Calculation of frequency, confidence intervals, the probability of the estimation error (magic “*p-value*”)
- Qualitative research: how and why?
 - ✓ From the Latin word “Qualis” (= How? What?)
 - ✓ Verbal analysis of relationships and contexts

Health risk assessment in doctor's everyday practice

Not only in prevention, but also in the diagnosis and treatment of diseases, doctors should ask the following questions (according to the US EPA):

- ✓ What symptoms can be causal in terms of exposure to environmental or occupational hazards?
- ✓ Is there a safe exposure level for the selected agent?
- ✓ Is there a possibility that some people will be exposed to significantly different exposure doses?
- ✓ Is it an exposure of an increasingly vulnerable (susceptible) population group (such as children, pregnant women, sick people, the elderly, people with occupational exposure)?

Conclusions

- Lost health can be restored medically.

But:

- Creation of health, health protection and health promotion in some ways exceeds the capacity of clinical medicine.
- The basis for the protection and promotion of health is a health risk assessment process built on a scientific basis.
- Principles of health risk assessment are very useful in clinical practice.