COMMUNICABLE DISEASES II.

Primary and secondary factors of the epidemic process.
Basic mathematical models of infectious diseases.
Attack rate, basic reproduction rate, prevalence, incidence, case fatality ratio.
MD tasks in case of detecting infectious disease.
PRIMARY driving factors of epidemic process

Source of infection (reservoir)
- Living humans or animals
- Inanimate environment

Mechanisms of transmission
- Direct contact
- Indirect contacts (mechanical or biological vectors as medium)

Susceptible host
- Immuno-status of hosts factors influencing it

Herd immunity
SE Népegészségtani Intézet
SOURCE OF INFECTION

- GENERALLY a living organism and very rare only inanimate matter, in which the infectious agent harbours, multiplies and leaving it enters to the susceptible hosts by different mechanisms, infecting them.

SOURCE OF INFECTION may be:

1. LIVING ORGANISM (humans, animals)
2. INANIMATE, INERT MATTER (climatic device)
RESERVOIR OF AN INFECTIOUS AGENT

Any person, animal, arthropod, plant, soil or substance or their combinations in which an infectious agent naturally lives and multiplies. Agent’s survival primarily depends on it in purposes to reproduce itself to be transmitted to a susceptible host.

- Natural storage system supports unlimited survival of infectious agent in the nature never becomes ill, only stores the agent may be transformed to a source of infections for example: leptospirosis (rats) tick-borne encephalitis (ticks)
SOURCE OF INFECTION: PERSONS

1. ILL PERSON - with clear, characteral symptoms

2. HEALTHY, ASYMPTOMATIC CARRIER (dangerous!)
   - it harbours agent without any clinical symptoms

- incubatory carrier (short and long duration)
  hepatitis, cholera, influenza, varicella, morbilli, scarlatina

- convalescent carrier
  dysenteria, cholera, diphtheria

- temporary carrier (short duration-in 1 year)

- chronic carrier (long duration-after 1 year also)
  salmonellosis,
  typhoid fever: Mary Mallon- cook!
  -1400 persons had been infected by her
SOURCE OF INFECTION: ANIMALS

1. DOMESTIC ANIMALS
   - dogs, cats, cattle: rabies (LYSSA)
   - goats, cattles, swine: brucellosis
   - horse: malleus

2. WILD ANIMALS LIVING NEAR THE HOUSE (rodents, mammals)
   - mouse: salmonella
   - fieldmouse: Tick-borne encephalitis
   - birds: ornithosis, chlamydia
   - hedgehogs: rabies
   - rats: plague
   - monkeys: Marburg disease, yellow fever
   - rabbits: tularaemia

3. LABORATORY ANIMALS
   - rats: leptospirosis
   - monkeys: SV 40-viral infection of polio-vaccines
SOURCE OF INFECTION: INANIMATE SUBSTANCE

1. Air-conditioner in case of legionellosis exceptionally accepted as source of infection:
   Living, multiplying forms of agent was detected in all cases
   (legionellosis may not spread from human to human!)

2. Dead organisms in some cases - ebola
   Most of microorganisms may not survive the death of host
   (cholera doesn't spread from died to living organism)
MECHANISMS OF TRANSMISSION

any mechanisms by which an infectious agent spreads from a source to a susceptible host

It depends on the ability of microorganism:

- to leave infected (ill) organism on some route
- to survive in the environment
- to penetrate soon a new susceptible host

WE CAN EFFECT ON THESE MECHANISMS WITH STERILISATIONAL AND DISINFECTIONAL METHODS ALSO
MECHANISMS OF TRANSMISSION

1. DIRECT TRANSMISSION
spreading without any substances
   - DIRECT CONTACT MECHANISM
   - PERINATAL MECHANISM
   - INTRANATAL MECHANISM

2. INDIRECT TRANSMISSION
spreading with living or inanimate substance
DIRECT MECHANISMS OF TRANSMISSION
I. DIRECT CONTACT

1. TOUCHING
2. HANDSHAKE
3. SLEEPING IN COMMON BED
4. SEXUAL INTERCOURSE
5. CLOSED OCCUPATION WITH ANIMALS
6. BITING
7. DIRECT SPRAY ONTO THE Conjunctivatives AND MUCOUS MEMBRANES

WHAT KIND OF DISEASES MAY SPREAD SIMILARLY?

1. enteral infections: enterobiasis, calicivíral –infections
2. dermato-infections: impetigo, favus stb. funges, erysipelas, scabies, leprosy
3. STD: Sexually Transmitted Diseases: syphilis, gonorrhoea, gardnerella, Herpes Simplex gen., Trichomoniasis, Chlamydia-infection
4. wound-infections: tetanus, oedema malignum, Staphylococcus aureus-, streptococcal infections
5. most of zoonoses: chlamydia, Q-fever, tularaemia, brucellosis, lyssa, anthrax, leptospirosis
DIRECT MECHANISMS OF TRANSMISSION

II. PERINATAL

DIAPLACENTAR MECHANISM

- CONGENITAL INFECTIONS
  (INNATE, ACQUIRED INTRAUTERNALLY)

1. on transplacentar haematogenous route with agents, appearing in maternal circulation
   - CMV, rubella, chickenpox, HIV, ParvoB19, toxoplasmosis

2. agents ascending to the uterus on delivery routes - CMV

3. pathogens from surrounding maternal organs, descending to the amniotic fluid

4. after transabdominal, intrauterin (diagnostic) intervention
DIRECT MECHANISMS OF TRANSMISSION

INTRANATAL MECHANISM: CONNATAL INFECTIONS
(ACQUIRED AT PARTUS, ADOPTED ON NATAL ROUTES)

- maternal infections (diseases, running during the childbearing)
  Hepatitis B, HIV, non-polio enteroviruses, non-typhoid salmonellas
- mucocutan contamination
- by inoculation of respiratory -and/or gastro-intestinal tract

- by potential pathogen mikroorganisms, existing in delivery routes
cervical, vaginal secretums
(baby infected transferring the birth-routes)
herpes simplex, CMV, Chlamydia trachomatis, Neisseria gonorrhoeae

POSTNATAL
-acquired infections
from environmental sources
INDIRECT MECHANISMS OF TRANSMISSION
I. VEHICLE-BORNE

-AIR aeroplankton: absorbed on solid and fluidal drops
pollens, pathogens (bacteria, funges, viruses, pollens)
schools, hospitals, flats, households, workplaces:
increased amount of saprophytes- increasing amount of pathogens
infections with droplets:
1. direct: (Pflügge), inhalation before sedimentation
2. indirect: inhalation after sedimentation
   (not only pathogens from respiratory tract !) chickenpox, worm-eggs, funges,

-WATER (drinking-bathing, sewage)-see: waterborn epidemic (London, cholera)

-SOIL level of infection
1. with faeces, urine animal and human origin
   Vibrio cholerae, Shigellas: days
   Leptospiros: years, Clostridias, B. anthracis: long-lasting
2. excretums: TBC bacterias – years
3. sewage-water, l: Salm. typhi, S. paratyphi, worm-eggs,
   cystas (amoebal dysenteria) – years

-FOOD medium of food-born diseases, food-intoxications

-ARTICLES FOR PERSONAL USE bed-chlothes, underwear, door-handles, toys, bedpan etc.

-MEDICAL INSTRUMENTS injectional needles, syringes, transfusional sets
INDIRECT MECHANISMS OF TRANSMISSION

II. VECTOR-BORNE

for ex.: arthropods (entomology)

MECHANICAL VECTORS
realised only mechanical transfer of infectious agents on its body
for ex.: fly, cocroaches - enteral diseases

BIOLOGICAL VECTORS:
passage of pathogens with infected blood of humans or animals from their body to the blood of host
required multiplication or development of pathogens in their body

for ex.:
malaria: malaria-mosquito (Anopheles)
plague: flies of rats
yellow fever: Haemagogus, Aedes-mosquitos, ticks
Lyme-borreliosis: ticks
typhus exanthematicus (louse-borne typhus): body-louses (Pediculus humanus)
## VIRAL HAEMORRHAGIC FEVERS

<table>
<thead>
<tr>
<th>INFECTIOUS AGENT</th>
<th>DISEASE</th>
<th>RESERVOIR</th>
<th>VECTOR</th>
<th>GEOGRAPHIC AREA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. FLAVIVIRIDAE</td>
<td>DENGUE-HAEM.FEVER</td>
<td>MONKEYS</td>
<td>MOSQUITOS</td>
<td>AFRICA, ASIA, AMERICA</td>
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<tr>
<td>- DENGUE-VIRUS</td>
<td>YELLOW FEVER</td>
<td></td>
<td></td>
<td>- AFRICA, AMERICA, ASIA, SIBERIA</td>
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<tr>
<td>- YELLOW FEVER-VIRUS</td>
<td>OMSKIAN HAEMORRH.FEVER</td>
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<tr>
<td>2. BUNYAVIRIDAE</td>
<td>R.-W-HAEM.FEVER</td>
<td>MAMMALS</td>
<td>MOSQUITOS</td>
<td>AFRICA</td>
</tr>
<tr>
<td>- RIFT-WALLEY FEVER-VIRUS</td>
<td>CR.-C.-HAEM.FEVER</td>
<td></td>
<td>TICKS</td>
<td>- AFRICA, ASIA</td>
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<tr>
<td>- CRIMEAN-CONGO HAEMORRH.FEVER-VIRUS</td>
<td>MVN-MUROID VIRUS-NEPHROPATHIA</td>
<td></td>
<td>SALIVA OR URINE</td>
<td>- ASIA, EUROPE, AFRICA</td>
</tr>
<tr>
<td>- HANTAAN-VIRUS PUUMALA.VIRUS</td>
<td>HAEMORRH.FEVER WITH NEPHRITIC SYNDROME</td>
<td></td>
<td>OF RODENTS</td>
<td>- SAME</td>
</tr>
<tr>
<td>3. ARENAVIRIDAE</td>
<td>A.R.ARGENTIN HAEMORRH.FEVER</td>
<td>RODENTS</td>
<td>RODENT'S URINE</td>
<td>A.SOUTH-AMERICA</td>
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<tr>
<td>- A.JUNIN-VIRUS</td>
<td>B.BOLIVIAN HAEMORRH.FEVER</td>
<td></td>
<td></td>
<td>- SOUTH-AMERICA</td>
</tr>
<tr>
<td>- MACHUPO-VIRUS</td>
<td>C.LASSA-FEVER</td>
<td></td>
<td></td>
<td>B.SOUTH-AMERICA</td>
</tr>
<tr>
<td>- GUANARITO-VIRUS</td>
<td>D.VENZUELAN HAEMORRH.FEVER</td>
<td></td>
<td></td>
<td>C.WEST-AFRICA</td>
</tr>
<tr>
<td>4. FILOVIRIDAE</td>
<td>M.V.CAUSED DISEASE</td>
<td>UNKNOWN</td>
<td>NOSOCOMIAL</td>
<td>WEST-AFRICA</td>
</tr>
<tr>
<td>- MARBURG-VIRUS</td>
<td>E.V. CAUSED DISEASE</td>
<td></td>
<td></td>
<td>WEST-AFRICA</td>
</tr>
<tr>
<td>- EBOLA-VIRUS</td>
<td></td>
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</tbody>
</table>
EXAMPLE FOR INDIRECT MECHANISM OF TRANSMISSION (VEHICLE-BORNE)
CHOLERA - AS A WATERBORNE INFECTION

WATERBORNE INFECTIONS - MAIN CHARACTERISTICS:

- coincidence of water-supply and diseases
- the cases occurred in enormous number suddenly and at the same time
- the possibility of water-contamination may be detected: the pathogen can be demonstrated from water
- suddenly decrease of cases after the watersource was locked up

1832-LONDON-CHOLERA EPIDEMIC
(1 MONTH-7000 CASES of death)
SOURCE: in the Soho in London (Soho-Broad Street) was a well, after removal of handle the epidemic chain wrung, the epidemic process was stopped in 3 days

STOP OF EPIDEMIC
JOHN SNOW
SUSCEPTIBLE HOST

SUSCEPTIBILITY:
- property of an organism to adapt an infection
- not possessing sufficient resistance against a pathogen
- depends on the immunostatus
increasing factors: exhaustion, cold, lack of proteins, radiations, pharmapreparats (cortison)

-individual susceptibility: person is capable to get an infection

-populational susceptibility: the proportion of not protected against an infection among the population

SUSCEPTIBILITY may be characterized with:
-infectiosity: in how many persons the inf.agent can be detected (from 100 contacts)
-contagiosity: how many persons will be ill (from 100 susceptible exposed to the infection persons)
SECONDARY DRIVING FACTORS OF EPIDEMIC PROCESS

are **not determinant factors** in occurrence of epidemics, but influencing their
- frequency
- seriousness
- extension
- duration

NATURAL FACTORS
- weather
- disasters
- climat
- pollution
- terrain-configuration
- water-supply reservoirs, vectors

Marine pollution in the Niger Delta
SECONDARY DRINKING FACTORS OF EPIDEMIC PROCESS

2. SOCIAL FACTORS

- social system
- poverty
- cultura
- education
- problems of sewage-water
- traffic
- public health care
- disaster-management
- nutrition, catering
- working stress

Syria refugee camp
Basic mathematical models of infectious diseases

Damped oscillations of the SIR model
Why do we need mathematical models in infectious diseases epidemiology?

• A mathematical model integrates knowledge and data about
  – natural history of the infectious disease
  – transmission of the pathogen between individuals
  – epidemiology
• in order to
  – better understand the disease and its population-level dynamics
  – evaluate the impact of interventions (for ex: vaccination, antibiotic or antiviral treatment, quarantine)
“Modeling can help to ...”

- Modify vaccination programs if needs change
- Explore protecting target sub-populations by vaccinating others
- Design optimal vaccination programs for new vaccines
- Respond to, if not anticipate changes in epidemiology that may accompany vaccination
- Ensure that goals are appropriate, or assist in revising them
- Design composite strategies, …”

Walter Orenstein, former Director of the National Immunization Program in the Center for Diseases Control (CDC)
Basic reproduction number

The basic reproduction number $R_0$ ("R nought") is a key quantity in infectious disease epidemiology.

$R_0$ - average number of secondary cases generated by one primary case in a totally susceptible population

IF

$R_0 < 1 \rightarrow$ number of cases decreases
$R_0 = 1 \rightarrow$ number of cases is stable
$R_0 > 1 \rightarrow$ number of cases increases

the bigger the value of $R_0$ the bigger the potential for spread of the infection within the population
Evaluation of the potential for spread of an infection

$R_0 = 4$
with whole population susceptible

$R_0 = 4$
with 75% population immune (25% susceptible)
$R_0$ depends on

- transmission parameters
- duration of infectiousness
- contact rate (average rate of contact between susceptible and infected individuals)
- community structure
# Values of $R_0$ of well-known infectious diseases

<table>
<thead>
<tr>
<th>Disease</th>
<th>Mode of Transmission</th>
<th>$R_0$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measles</td>
<td>Airborne</td>
<td>12–18</td>
</tr>
<tr>
<td>Pertussis</td>
<td>Airborne droplet</td>
<td>12–17</td>
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<tr>
<td>Diphtheria</td>
<td>Saliva</td>
<td>6–7</td>
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<tr>
<td>Smallpox</td>
<td>Social contact</td>
<td>5–7</td>
</tr>
<tr>
<td>Polio</td>
<td>Fecal-oral route</td>
<td>5–7</td>
</tr>
<tr>
<td>Rubella</td>
<td>Airborne droplet</td>
<td>5–7</td>
</tr>
<tr>
<td>Mumps</td>
<td>Airborne droplet</td>
<td>4–7</td>
</tr>
<tr>
<td>HIV/AIDS</td>
<td>Sexual contact</td>
<td>2–5</td>
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<tr>
<td>SARS</td>
<td>Airborne droplet</td>
<td>2–5</td>
</tr>
<tr>
<td>Influenza (1918 Strain)</td>
<td>Airborne droplet</td>
<td>2–3</td>
</tr>
<tr>
<td>Ebola</td>
<td>Direct contact</td>
<td>1.5–2</td>
</tr>
</tbody>
</table>
Evaluation of the potential for spread of an infection

• Vaccination reduces the proportion of susceptibles in the population
• The minimal immunization coverage needed to eliminate an infection in the population (V-critical vaccination coverage) is related to $R_0$ by the relation
  \[ V = 1 - \left( \frac{1}{R_0} \right) \]
  (assuming that vaccine effectiveness is 100%)

Source: Thierry Van Effelterre - Mathematical Models in Infectious Diseases Epidemiology
Critical vaccination coverage required to restrain the spread

<table>
<thead>
<tr>
<th>Disease</th>
<th>Mode of Transmission</th>
<th>$R_0$</th>
<th>min $V$ [%]</th>
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</thead>
<tbody>
<tr>
<td>Measles</td>
<td>Airborne</td>
<td>12–18</td>
<td>91,7-94,4</td>
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<tr>
<td>Pertussis</td>
<td>Airborne droplet</td>
<td>12–17</td>
<td>91,7-94,4</td>
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<tr>
<td>Diphtheria</td>
<td>Saliva</td>
<td>6–7</td>
<td>83,3-85,7</td>
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<tr>
<td>Smallpox</td>
<td>Social contact</td>
<td>5–7</td>
<td>80,0-85,7</td>
</tr>
<tr>
<td>Polio</td>
<td>Fecal-oral route</td>
<td>5–7</td>
<td>80,0-85,7</td>
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<tr>
<td>Rubella</td>
<td>Airborne droplet</td>
<td>5–7</td>
<td>80,0-85,7</td>
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<tr>
<td>Mumps</td>
<td>Airborne droplet</td>
<td>4–7</td>
<td>75,0-85,7</td>
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<tr>
<td>HIV/AIDS</td>
<td>Sexual contact</td>
<td>2–5</td>
<td>50,0-80,0</td>
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# Vaccination coverage in Hungary

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<td><strong>HepB_BD</strong></td>
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<td><strong>Hib3</strong></td>
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<td><strong>MCV</strong></td>
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<td><strong>PnC3</strong></td>
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<td><strong>Pol3</strong></td>
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<td><strong>Rota_last</strong></td>
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MCV - Measles-containing vaccine

WHO vaccine-preventable diseases: monitoring system

**WHO-UNICEF estimates of MCV coverage**
**Incidence** - The number of new cases of a specified disease reported during a defined period of time, divided by the number of persons in a stated population in which the cases occurred (usually expressed as cases per 1,000 or 100,000 per annum)

**Attack rate** (case rate) - is a proportion measuring cumulative incidence often used for particular groups, observed for limited periods and under special circumstances, as in an epidemic; it is usually expressed as percent (cases per 100 in the group).

\[
\text{Attack Rate} = \frac{\text{number of new cases among the population during the period}}{\text{population at risk at the beginning of the period}} \times 100
\]

Attack Rate is used: - in hypothetical predictions and during actual outbreaks of disease -to project the number of victims to expect during an epidemic

**Secondary attack rate** - is the proportion of those exposed to the primary case that develop disease as a result of the exposure
Case fatality rate (CFR)

CFR is the proportion of deaths within a designated population of "cases" (people with a medical condition), over the course of the disease.

$$\text{CFR} = \frac{\text{number of deaths}}{\text{number of cases}}$$

CFR is conventionally expressed as a percentage and represents a measure of risk. CFRs are most often used for diseases with discrete, limited time courses, such as outbreaks of acute infections.
Herd immunity

Herd immunity occurs when the vaccination of a significant portion of a population provides a measure of protection for individuals who have not developed immunity.
MD tasks in case of detecting infectious disease
THE MOST FREQUENT EPIDEMIC INDICATORS CHARACTERISING THE INFECTIOUS DISEASES

MORBIDITY- MORBIDITY RATE
- NUMBER OF PEOPLE ACQUIRED THE SAME ILLNESS DURING THE SAME 1 YEAR REFERRING TO THE MIDYEAR POPULATION ON 100,000 PEOPLE

MORTALITY – MORTALITY RATE
- NUMBER OF PEOPLE DIED FROM THE SAME DISEASE DURING THE SAME 1 YEAR, REFERRED TO THE MIDYEAR POPULATION ON 100,000 PEOPLE

LETHALITY - PERCENTAL PROPORTION OF DIED PEOPLE IN THE GIVEN DISEASE DURING THE SAME YEAR REFERRED TO THE NUMBER OF PEOPLE ACQUIRED THE GIVEN DISEASE IN THE SAME YEAR
- RABIES- NEARLY 100%
- INFLUENZA- ABOUT 1%

INFECTIOSITY RATE - FROM 100, CONTACTED WITH INFECTIOUS PEOPLE IN HOW MANY CASES COULD BE DETECTED THE INFECTIOUS AGENT

CONTAGIOSITY RATE - FROM 100 SUSCEPTIBLE PERSON EXPECTED TO THE INFECTION HOW MANY BECOMING ILL
PREVENTION OF INFECTIOUS DISEASES AND EPIDEMIES
ARRANGEMENTS ON THE SOURCE OF INFECTIONS AND ITS
ENVIRONMENT

-EPIDEMIC OBSERVATION
-EPIDEMIC ISOLATION
-QUARANTINE
-EPIDEMIC CONTROL
(CARRIER STATE- transient and chronic carrier state)

WE CAN EFFECT ON THE SOURCE OF INFECTIONS AND ITS ENVIRONMENT WITH EPIDEMIC ARRANGEMENTS
CONTROL OF COMMUNICABLE DISEASES

GENERAL PREVENTIVE MEASURES-CONTROL OF PATIENTS, CONTACTS AND ITS IMMEDIATE ENVIRONMENT:

1. prompt recognition and identification of a disease (epid. anamnesis, clinical examination, epidemic laboratory investigation)
2. treatment of patients
3. isolation of infectious source
4. early laboratory diagnosis
5. report (CASES-EPIDEMICS) notification, registration and deregistration of communicable diseases
6. disinfection
7. immunisation, chemoprophylaxis
8. epidemic observation
9. epidemic control
10. quarantine
11. epidemic surveillance
CONTROL OF COMMUNICABLE DISEASES
REPORT OF CASES AND EPIDEMICS

REPORT OF CASES

- IT IS DETERMINED BY LAW REGULATIONS WHICH DISEASES HAVE TO BE REPORTED AS A ROUTINE AND REGULAR PROCEDURE AND WHICH REPORTS ARE FORWARDED TO THE NEXT SUPERIOR JURISDICTION.

- GENERALLY IT IS DETERMINED WHAT DISEASES AND INFECTIOUS AGENTS HAVE TO BE REPORTED IMMEDIATELY BY CALL, FAX AND ONLINE BECAUSE OF THEIR EPIDEMIC DANGER.

- FROM PHYSICIANS IT’S REQUIRED TO REPORT ALL NOTIFYABLE ILLNESS COMING IN THEIR ATTENTION.

- IN HOSPITALS A SPECIFIC OFFICER SHOULD BE CHARGED WITH THE RESPONSIBILITY FOR SUBMITTING REQUIRED REPORTS (INDIVIDUAL OR GROUP-CASES).

- REPORT OF EPIDEMICS
REPORT AND NOTIFICATION OF COMMUNICABLE DISEASES IN HUNGARY

• the patient-supplier

• (GP or practitioner established the cause of death has to notify
  • -in 24 hours
  • -for the cognizant medical polity-organs
  • -by the permanent or abode address of the patient
  • and should be reported the circumstances of outcomes: if the patient recovered
    with complications or permanent alterations
  • -if there is a microbiological evidence
  • (laboratory investigation proved) about the infectious agent playing role in the
    given case –by the laboratory (supplier) should be reported
  • –with (Bacillus anthracis, Bordetella pertussis, Borrelia recurrentis,, Clostridium
    botulinum, Corynebacterium diphtheriae, Ebola-virus, poxvirus, Humán –disease
    causing avianinfluenza-virus, morbillivirus, Lassa-virus, Legionella
    pneumophyla, Marburg-virus, Mumps-virus, Mycobacterium leprae, west-nile
    virus, Polioviruses, Burkholderia (Pseudomonas) mallei, Rabies virus, Rikettsia
    prowazeki, Rift-walley fever- virus, Rubeolavirus, Salmonella Typhi, Salmonella
    Paratyphi A, B, C, SARS-coronavirus, yellow fever virus, Vibrio cholerae, Yersinia
    pestis
  • -or in some cases without personal data the disease (STD-s HIV-AIDS)
Reportable diseases

Should be reported in written form, online, phone and fax to the national epidemic center and to the county health authority:
anthrax, botulism, cholera, diphtheria, febris flava, febris recurrens, lyssa, malleus, pestis, poliomyelitis anterior acuta, SARS, typhus abdominalis, typhus exanthematicus, variola, viral haemorrhagic fevers

should be reported aggregated occurrence of cases transmitted from humans to humans, and cases manifesting in unusual form or increased number.

Nosocomial infections reportable with personnel data
clostridium difficile infection, infections caused multi-drug resistant (MDR) bacteria, sepsis

Reportable without personnel data:
AIDS, HIV-infection, STDs
CONTROL OF COMMUNICABLE DISEASES
REPORT OF CASES AND EPIDEMICS

• REPORT OF EPIDEMICS:

- ANY UNUSUAL OR GROUPED-EXPRESSION OF ILLNESS MAY BE OF PUBLIC-UTILITY
  (TO THE LOCAL HEALTH AUTHORITY BY THE MOST EXPEDITIOUS MEANS)
- IS IT INCLUDED OR NOT ON THE OFFICIAL LIST OF REPORTABLE COMMUNICABLE DISEASES
- IS A WELLKNOWN IDENTIFIED DISEASE
- HAVING AN INDEFINITE OR UNKNOWN CLINICAL ENTITY
LOCAL HEALTH AUTHORIAL ACTIVITY
IN HUNGARY IN THE MEDICAL ATTENDANCE

• TO PREVENT AND COMBAT THE COMMUNICABLE DISEASES IS NECESSARY TO BE SUPPLIED WITH

- THE CAPITAL- AND COUNTY-GOVERNMENTAL MAGISTERIAL INSTITUTION
  (AS COUNTY TOWN PUBLIC HEALTH -SPECIAL CONDUCTIVE ORGAN)

- CAPITAL-DISTRICTIAL (regional)
  AND AREAL (TOWNSHIP) PUBLIC HEALTH INSTITUTION
EPIDEMIC ARRANGEMENTS TO THE PATIENT, SUSPICIOUS ON AN INFECTIOUS DISEASE:

- **EPIDEMIC OBSERVATION**
  summary of arrangements of public health authority on a patient or suspects on an infectious disease to prevent the spread of pathogens to susceptible hosts by any mechanisms of transmission

- **EPIDEMIC CONTROL:**
  any epidemiological activities of health authorities on the pathogen-carriers

- **QUARANTINE:**
  separation of epidemiologically observed people
ISOLATION

Prevention or restriction of direct or indirect spreading (transmission) of an infectious agent in protection of susceptible persons

WHOM?
- ill and suspicious person animal,
- or its contacts

WHERE?
- on infectious ward of marked county or state-hospital
(diseases, prescribed in law and if the patient cannot be separated at home)
- on special place

HOW LONG?
- on time - intervall of infectious ability
- time of isolation: incubational period of disease
- finish: end of infectious status (time of deliberation from status)
- or in 48 hours after the general incubational period of disease
  if the disease could be enclosed by medical investigations
- should be discontinued if it is not indicated
ISOLATION

IS A

- **SEPARATION** OF INFECTED PERSONS OR ANIMALS FROM OTHERS
  FOR THE PERIOD OF COMMUNICABILITY-

  IN SUCH PLACES AND UNDER SUCH CONDITIONS

- **AS TO PREVENT THE DIRECT OR INDIRECT TRANSMISSION OF THE INFECTIONOUS AGENT** FROM INFECTED PERSONS TO THOSE WHO ARE SUSCEPTIBLE TO INFECTION OR WHO MAY SPREAD THE AGENT TO OTHERS
1. **strict isolation** to prevent transmission of highly contagious or virulent infections (spreading by air and contact)
   - private room, use of masks, gowns, and gloves for all persons entering the room
   - special ventilation requirements with a negative pressure in the room
2. **contact isolation** - for less highly transmissible and contagious diseases - spread by close or direct contact
   - Private room is indicated, but patients with the same pathogen may share a room. Indicated: masks, gowns, gloves
3. **respiratory isolation**: private room, but patients with the same pathogens may share a room. Only mask indicated
4. **tuberculosis isolation** - for patients with pulmonary TBC with + sputum or chest X-ray with active tuberculosis - private room with specific ventilation, closed door. Mask, gowns are indicated
5. **enteric precautions** - private room, if patient's hygiene is poor - gowns!
6. **drenage/secretion precautions** - cut direct or indirect contact with purulent material or drenage - gowns!
BASIC REQUIREMENTS COMMON FOR ALL POTENTIALLY INFECTIOUS CASES

• HANDS MUST BE WASHED AFTER CONTACT WITH THE PATIENT OR POTENTIALLY CONTAMINATED ARTICLES OR BEFORE TAKING CARE OF ANOTHER PATIENT

• ARTICLES CONTAMINATED WITH INFECTIOUS MATERIAL SHOULD BE APPROPRIATLY DISCARDED OR BAGGED AND LABELLED BEFORE BEING SENT FOR DECONTAMINATION AND REPROCESSING
EPIDEMIC OBSERVATION

arrangements of local health authority:
- on the source of infection (ill or suspicious cases)
- on their contacts
to prevent spreading of infection-epidemy (infectious diseases,determined by Order)

DURATION: max. incubational period of the given infectious disease

person under epidemic observation is obliged to:

- undergo a medical examination
- provide laboratory with necessary material (by epid.considerations)
- apply the necessary treatment to recovery
- take the physician’s advices

during the observation persons may be
- restricted to work
- jure in personal contacts
- freedom of movement

-will be restricted to work and exist on places where may cause massive infection
the physician may order the epidemic isolation
QUARANTINE

SPECIFIC AND STRICT FORME OF EPIDEMIC OBSERVATION
ON A MARKED FOR THIS REASON PLACE,
IN CASE OF
-highly contagious,
-diseases with very serious consequences

person, isolated in these circumstances cannot leave this place!

DELIBERATING INVESTIGATIONS
may be: absolute and modified quarantine
-restriction to visit hospital wards
-child-care institutions: (counting last case on incubational period
absolute: no admission and no leaves from department
modified: selective, partial limitation of freedom movement of contacts related to the danger of transmission: exclusion of children from school

QUARANTINE:
for ex.: typhus exanthematus: 20 day (suspicion + louses)
 febris recurrens: 14 days (susp. + louses!)
 cholera susp.: 2x3 days - investigations 2x neg!
 malleus: 6 days
 yellow fever 6 days
 plague 7 days + Tetracyclin, Sulfonamid
 viral haemorrhagic fevers and susp.
EXEMPLAR FOR ISOLATION (Singapur, 2006)
Negative Air Pressure
"Infectious Mode"

Positive Air Pressure
"Protective Mode"

General Exhaust Valves

Exhaust

Supply Air

Supply Air Valves

Magnetic Door

Active Pressure Monitor

Operator Workstation

Controls connected to nurses' station and facility management systems.

Nurses' Station
3 unit-isolation room for patients, with opportunities to change clothes and hand-disinfection
isolational tent (camp) (USA)( anywhere applicable)
EPIDEMIC SURVEILLANCE

EPID.SURVEILLANCE: epidemiological investigation of an infectious disease as a dynamic process

- extended on the
- ecology of infectious agent
- host organisms
- vectors and reservoirs
- complex mechanism of transmission of disease
- transmission and spreading of the infection

-tracing of the
- morbidity
- mortality
- case fatality rate
- circulation of the infectious agent in the population or in among the animals

-scruining the
- immunostatus of people (seroepidemiology)
- factors facilitating disease transmission
- estatuating the epid.situation of infectious diseases and giving a prognose and plan of arrangements in an epidemic situation
- sumarizes the defensive and preventional tasks

-for ex.: influenza-surveillance-working control-network, extended on the world (sentinels: in the memberstates of EU)
- TBC(tuberculosis)-surveillance
 - lyssa surveillance
- influenza-surveillance etc.
REASONS OF THE SURVEILLANCE

- detection of epidemics
- epidemic prognose
- follow of the endemic disease-trends
- evaluation of interventions
- analysis of futurial effects of the given disease.

Sentinel surveillance
detection of bioterror-actions
Surveillance of communicable diseases

- **ECDC**: Monitoring and analysing trends in infectious diseases across Europe. Since 2006, has been fed into a single, unified database.

- **TESSy database (2006)**: European Surveillance System - data on all the key infectious diseases monitored at EU level.
international surveillance system: Detected infectious disease

- variola
- Poliomyelitis
- Influenza (new subtype)
- SARS

- any infectious disease may have international consequences

- cholera
- plague (pulmonary form)
- Yellow fever
- Viral haemorrhagic fever
- west Nile fever

- is there any serious expected public health consequences of the given disease?
- is it an unconventional or unexpected event? is there any odds of international sweeping?
- it could affect on the international travels/commerce?

if there are min. 2 true statements above

should be notified to the WHO
EPIDEMIC CONTROL

THE CLINICAL RECOVERY IS NOT EQUAL TO THE STOP OF THE COMMUNICABILITY:

EPIDEMIC CONTROL:
- DELIBERATORY LABORATORY INVESTIGATIONS
- control of communicability
- positive result: carriers - isolation: yes or not
  (typhus abdominalis, paratyphus, dysenteria, typhus exanthematicus-Brill disease etc.)

restriction from activities where they may cause massive occurrence of disease,
danger of food- and water-contamination
hotel-trade, commercialism
and suitable branches of child-, and healthcare

may obliged on:
- disinfection of articles for personal use
- provide with material for laboratory investigation
- notification, report of movement to another settlement
- restriction of visiting school
Epidemiological arrangements connected to people from abroad

- arrived from countries
- persons
- vehicles and
- its personnel and cargo where the

- cholera, plague, yellow fever, viral haemorrhagic fevers, typhus exanthematicus occurrence
- is endemic or epidemic,

- should be done medical and epidemiological investigations and to take epid. arrangements depended on the results in purposes to stop the transmission of the given communicable disease
CARRIER STATUS

HUMAN OR ANIMAL ORGANISM

I. - ILL PERSONS
II. - ASYMPTOMATIC CARRIERS

INCUBATIONAL CARRIERS
- are infectious during the incubational period also
  (hepatitis, cholera, influenza, morbilli, scarlatina, varicella stb.)

RECONVALESCENT CARRIERS
- they are infectious for susceptibles after the recovery no more than 4 weeks (dysenteria, cholera, diphteria etc.)

TRANSIENT CARRIERS
after 4 weeks, but in 1 year the clinical recovery also are carrying the pathogens
  (cholera, typhoid fever, paratyph A,B

CHRONIC CARRIERS:
remained carriers more than 1 year: cholera, typhoid fever, paratyphus A,B
- to find them is very important public health task:
  may become important sources of infection
EPIDEMIC LABORATORY INVESTIGATIONS

1. diagnostic investigations
2. deliberatory investigations
3. screening investigations

GOALS:
1. to prove the diagnose
2. control of communicability
3. to find transient and chronic carriers
EPIDEMIOLOGICAL LABORATORY- INVESTIGATIONS

OBLIGATORY INVESTIGATIONS
faeces:
Ty.abd., Paratyphus, urine also!
salmonellosis, dysenteria, dyspepsia coli
cholera, poliomyelitis, ankylostomiasis, teniasis, malleus

blood:
Ty.abd, Paratyphus, polio, Ty.ex., brucellosis, tularaemia, malleus,
leptospirosis, echinococcosis, trichinelliosis
sputum and pus:
anthrax, plague

NOT OBLIGATORY, BUT ADVISED INVESTIGATIONS
-without any previous discuss:
adeno viral infections, ascariasis, coli - enteritis
encephalitis, giardiasis, influenza, choriomening. lymphocyt., mening.epid.,
-fever, scarlet fever, tetanus, trichomoniasis, trichiuriiasis + suspicion

-with previous discuss:
listerosis, mononucleosis, pertussis, toxoplasmosis + suspicion

EPIDEMIC LABORATORY BACKGROUND:
-district-TOWNSHIP
-settlement
-county
-national levels
LABORATORY INVESTIGATIONS APPLIED IN EPIDEMIOLOGICAL INTERESTS

1. microbiological screening laboratory examinations in epidemiological interests:

screening examination, directed on the establishment of
microbiological carrier-status of a person, not showing the symptoms
of the given disease (asymptomatic) in a reason of
-to give effect to
-to execute or
-to finish authorial epidemiological arrangements

2. or deliberatory laboratory investigations:
: microbiological investigation to establish the infectious ability
  of a recovered from the given disease person

3. epid control investigations:
: microbiological investigation for epidemiological authorial control
  of a qualified to TRANSIENT or CHRONIC carrier persons

4. screening laboratory investigations applied in the closed environment of ill patient:

screening examination of contacts during the incubational period;
1. Screening laboratory investigations for persons exposed to increased risk
   screening examinations of determined populational groups not showing the symptoms of the given hospitalized patients, pregnant women

2. Microbiological diagnostic investigations:
   health care-provision proving the habitation of the microbiological causative agent
   in the suspicious for the given disease patient’s organism, amely with a direct or indirect method

3. Clinical microbiological diagnostic investigations:
   microbiological diagnostical investigation in a purpose of determination and application of suitable personal therapy created on the basis of the individual diagnosis;

4. Microbiological diagnostic laboratory investigations applied in epidemiological interests:
   microbiological diagnostic examination created in a reason of early detection, analysis of populational risks and to find the suitable intervention on populational level in preventative purposes,
1. **Persons, prooved infectious** by the enruled in the jurisdiction and applied by this reason obligatory preliminary or periodical medical examinations, cannot be applied for a work and cannot be occupied with determined activities by the jurisdiction.

   - After a nosocomial infection case should be done a screening examination at the workers of given unit of workplace of the given health provisioner. Workers carrying the infectious agent of a nosocomial infection should be prohibited from medical attendance examination, treatment.

2. **HIV-positive, or infective chronic carriers of virulent virus of hepatitis B or C medical workers** cannot hold a position with participation in invasive interventions, predisposing for any exposure.