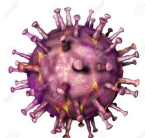
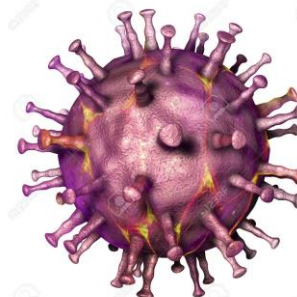




UNIwersytet Medyczny
IM. PIASTÓW ŚLĄSKICH WE WROCŁAWIU



Subject: Faculty Lectures of Virology

Topic: Childhood diseases



Academic Year 2024/2025

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Faculty: Medicine
Field of study: Virology
Level of study (uniform MA):
Form of study (full time):
Year of study: III

Academic title/professional title: professor
Name, last name of the lecturer: Beata Sobieszczkańska
Position of person conducting classes: the person responsible
for the subject
Wrocław Medical University
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Childhood diseases

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graph TD; A([Childhood diseases]) --> B(DNA viruses); A --> C(RNA viruses); B --> B1[VZV]; B --> B2[HHV-6 & -7]; B --> B3[Parvovirus B19]; C --> C1[Rubella]; C --> C2[Measles]; C --> C3[Mumps]; C --> C4[Coxsackie];
```

DNA viruses

VZV

HHV-6 & -7

Parvovirus B19

RNA viruses

Rubella

Measles

Mumps

Coxsackie

Common characteristics:

- Air-borne route (exception - HFMD)
 - Rash (exception - mumps)

Incubation period

3-7 days

14 days

21 days

28 days

HHV-6

HFMD & HHV-6

MUMPS

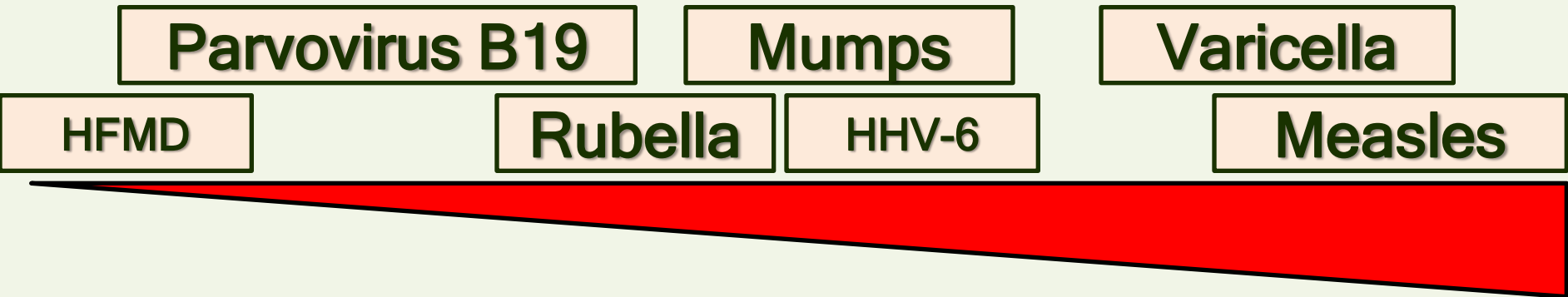
MEASLES

VARICELLA

RUBELLA

ERYTHEMA INFECTIOSUM

Severity of the disease



Prevention (vaccine)

MMR = mumps, measles, rubella

MMRV = mumps, measles, rubella, varicella

Varivax - varicella

Treatment: Acyclovir, gancyclovir (varicella, HHV-6)

Seasonality

winter



spring



summer



fall



Measles

Rubella

HFMD

Varicella

Parvovirus B19

Mumps

HHV-6

COMMON

Roseola infantum

(the sixth disease)

Erythema infectiosum

(the fifth disease)

**Hand-foot-and-mouth
disease**

UNCOMMON

Varicella-zoster

Rubella

Measles (?)

Rash

maculopapular

Rubella

Parvovirus B19

HHV-6

Measles



No rash

Mumps

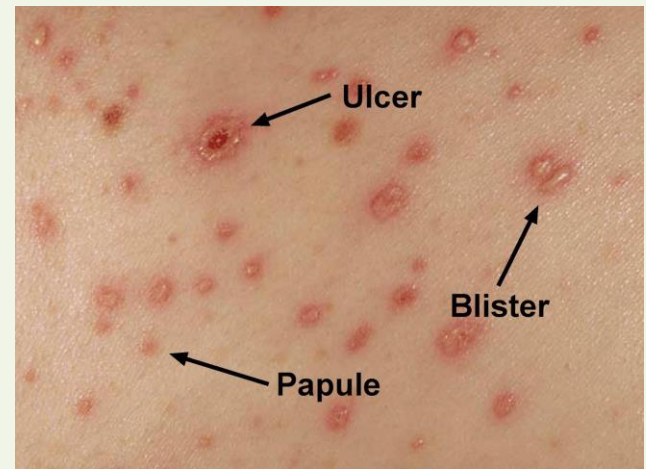
vesicular

HFMD



Macules-papules-vesicles

Varicella



maculopapular

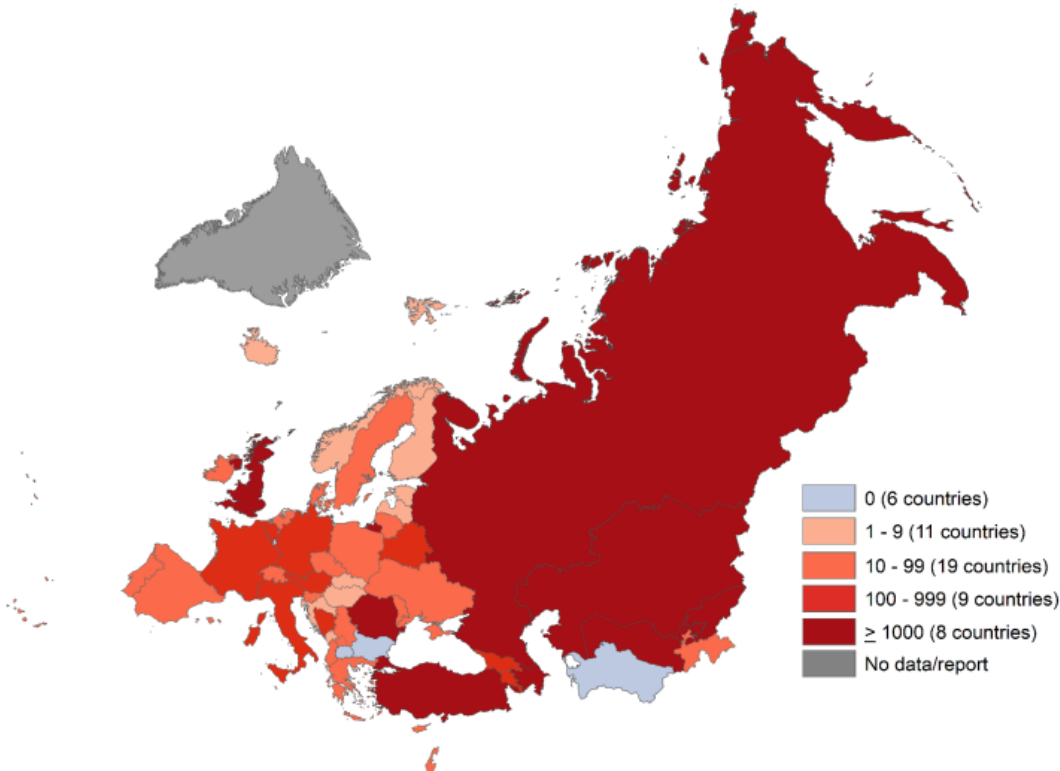


vesicular



Measles

Measles cases—WHO European Region,
April 2023–March 2024



Top 10 countries	
Country	Cases
Kazakhstan	36292
Azerbaijan	28855
Russian Federation	18977
Kyrgyzstan	14472
Romania	4773
Türkiye	4698
Uzbekistan	1899
United Kingdom	1008
Armenia	697
Austria	456

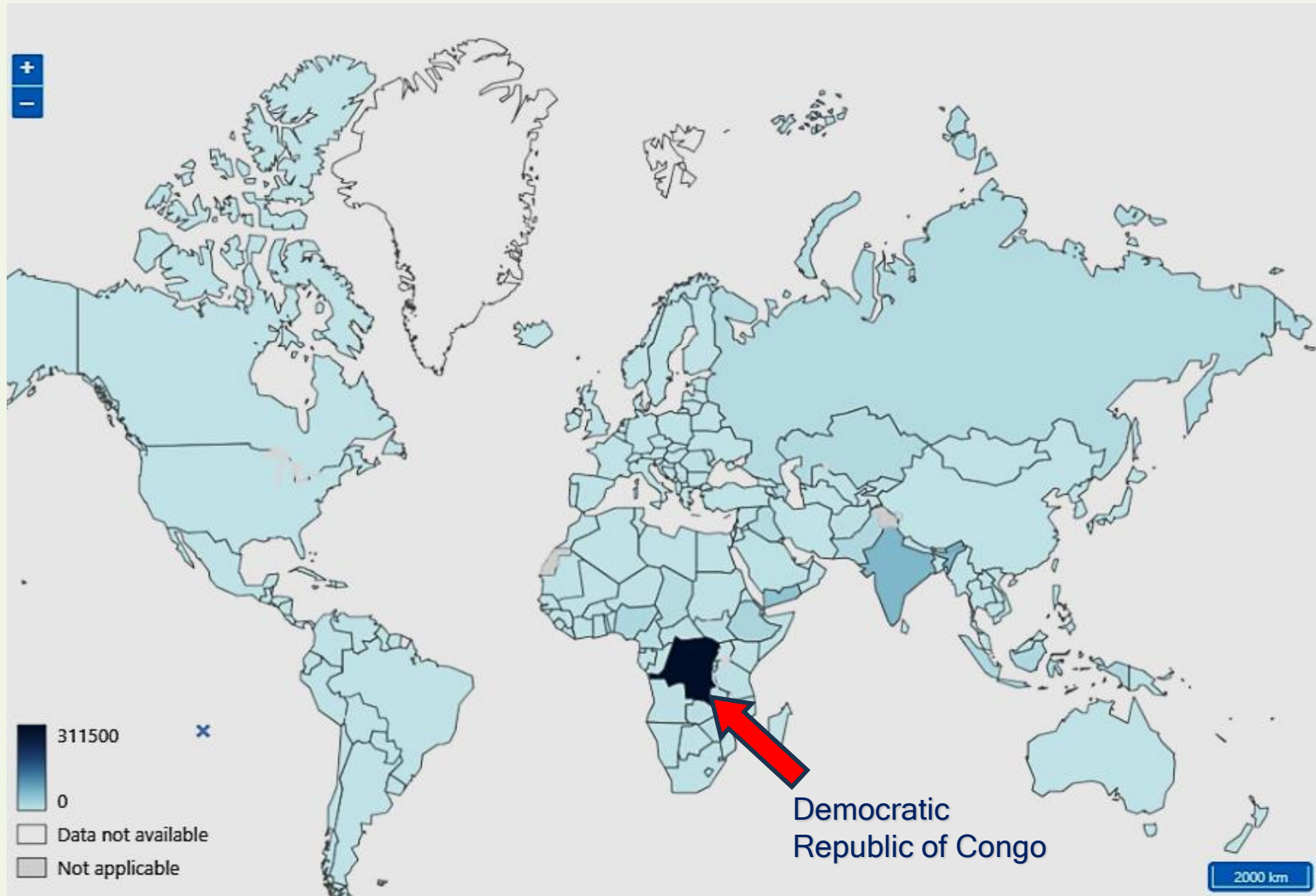
47 (89%) countries reported measles cases in the rolling 12-months.

Elimination is defined as zero incidence of a disease in a defined geographical area, whereas **eradication** refers to 0 incidence of the disease worldwide

Measles

An estimated 107 500 people died from measles in 2023

At present, measles is still highly prevalent throughout the world, with an estimated annual 7 million cases and more than 100,000 deaths worldwide



Winter

Air-borne
direct contact

Measles
virus

10-12 days

Measles
(German rubella)



symptoms

Prodromal: **3xC's**:
coryza, **c**ough, **c**onjunctivitis



Maculopapular rash: face then
generalized

Complications:
Blindness, diarrhea,
pneumonia (60% deaths)

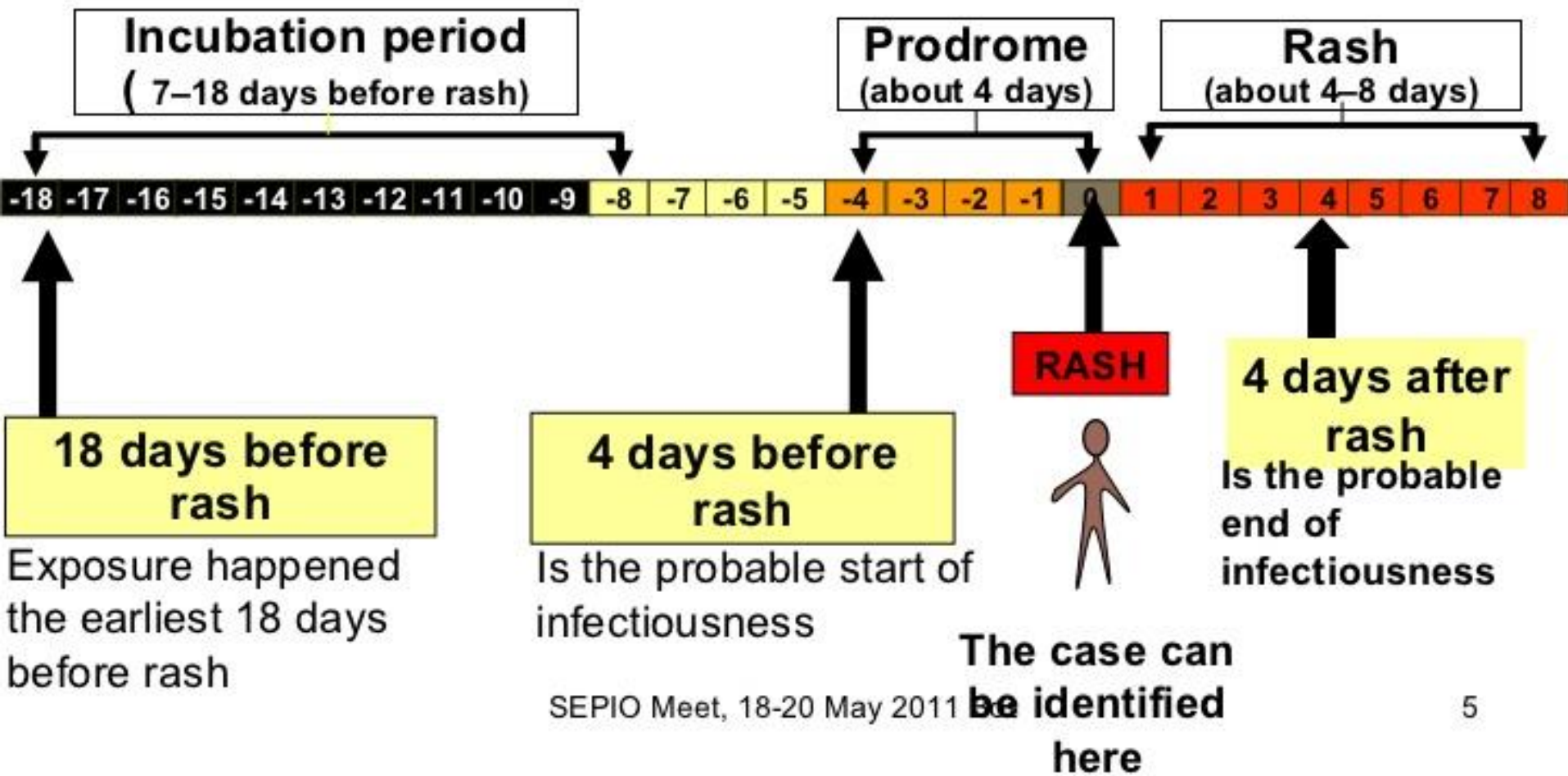


Koplik's spots in mouth

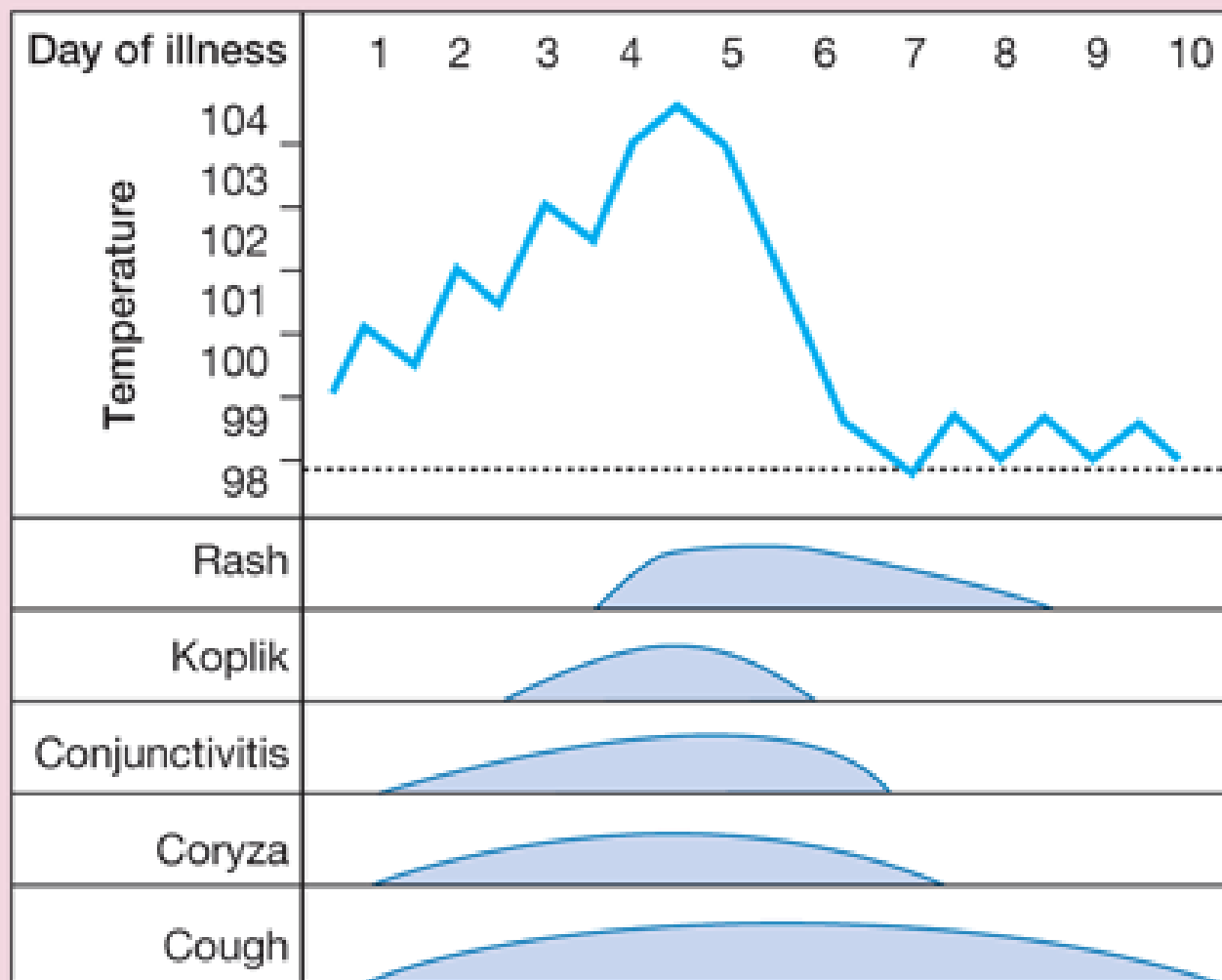
CNS disorders

MMR vaccine

Clinical course of measles

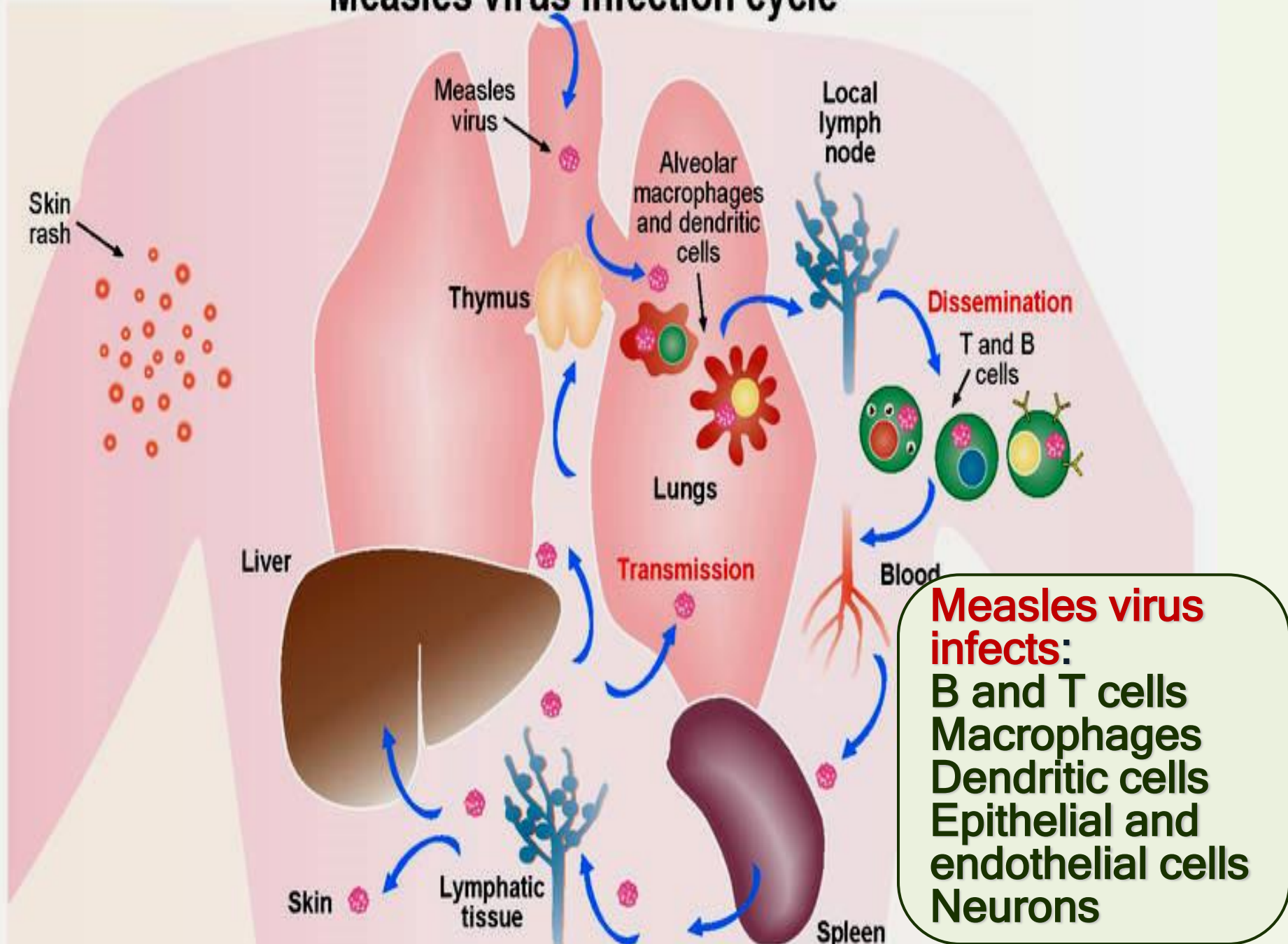


Clinical course of typical measles



Source: Goldsmith LA, Katz SI, Gilchrist BA, Paller AS, Leffell DJ, Wolff K: *Fitzpatrick's Dermatology in General Medicine*, 8th Edition: www.accessmedicine.com

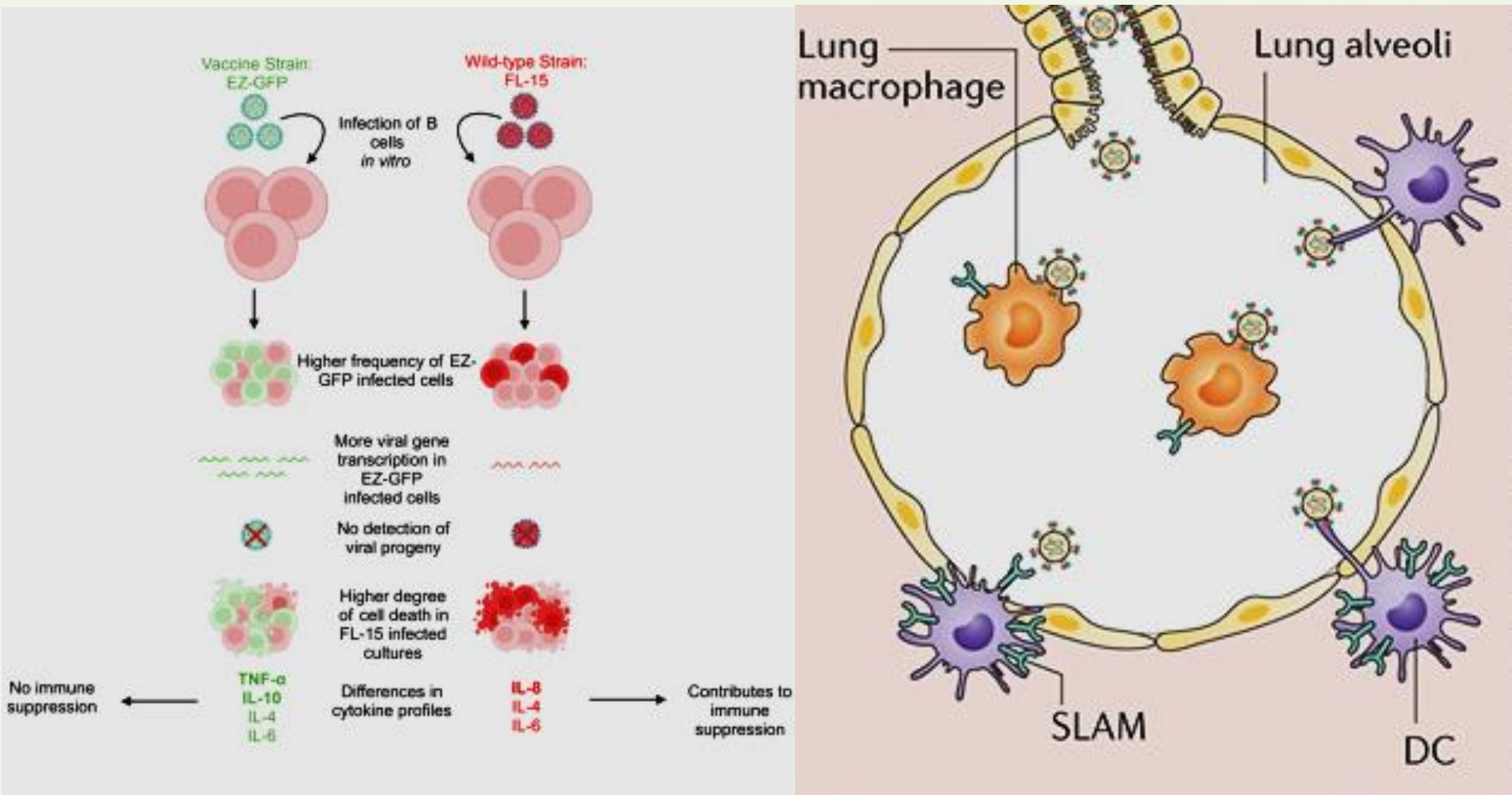
Measles virus infection cycle



Measles virus infects:
B and T cells
Macrophages
Dendritic cells
Epithelial and endothelial cells
Neurons

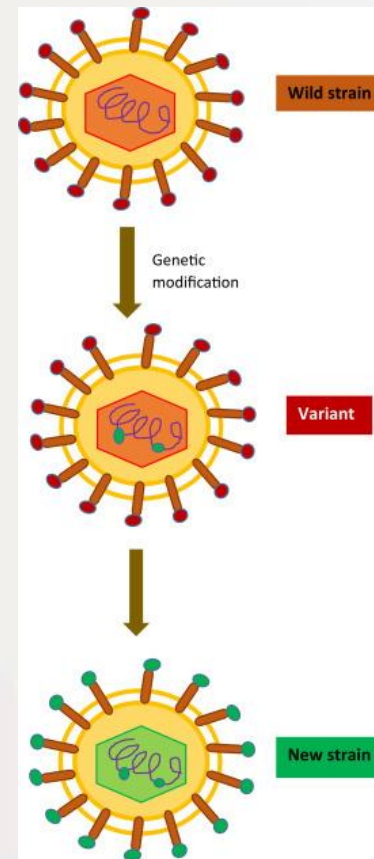
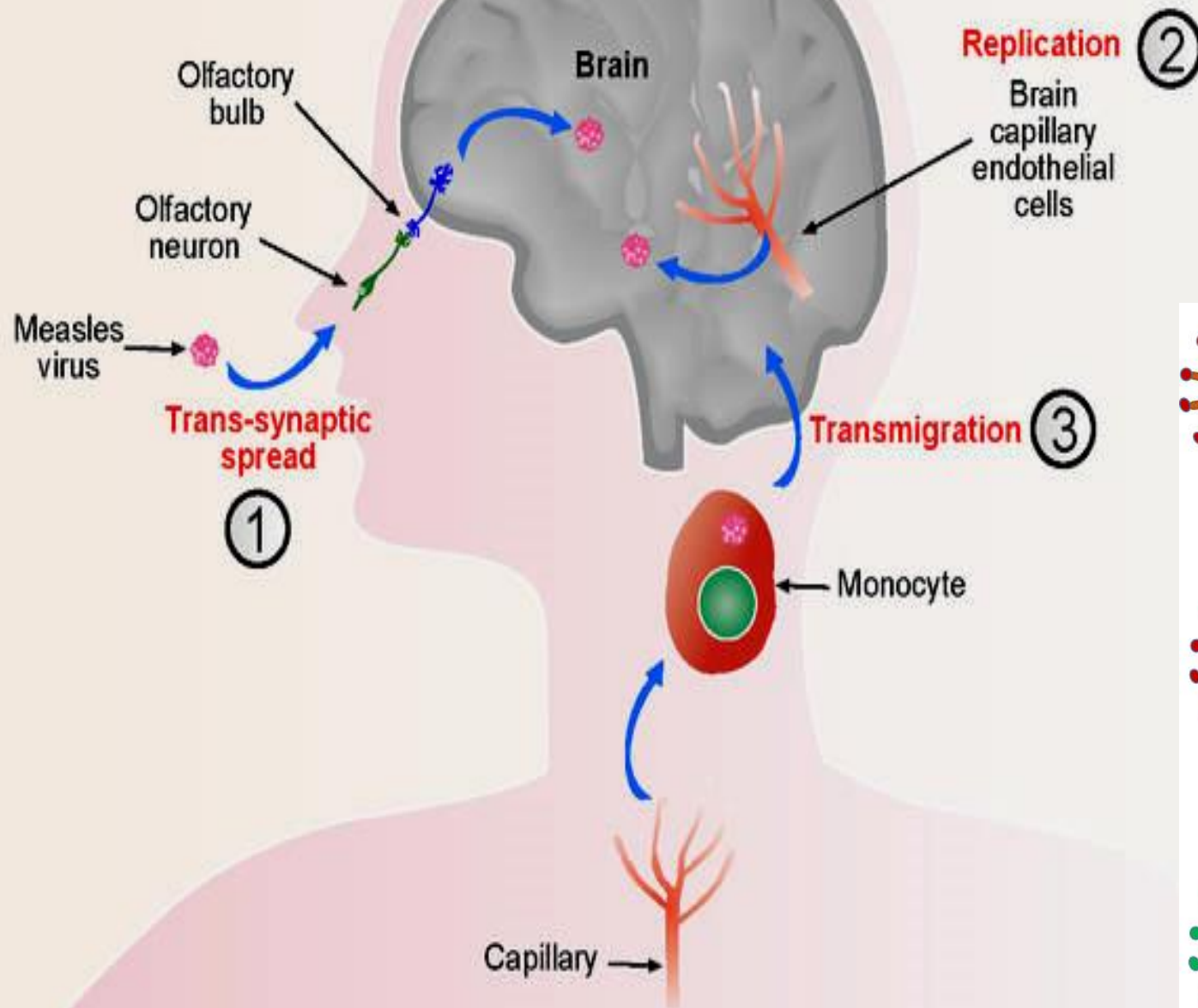
Measles

Immune Amnesia: How immune system forgets to fight



SLAM = Signalling Lymphocytic Activation Molecule = MV receptor for fusion

Potential routes of measles virus dissemination to the brain



Acute viral encephalitis
(brain swelling)

During rash in 1-3/1000 cases
MR 10-15% children; 25% adults

**Acute disseminated
encephalomyelitis (ADEM)**
most frequent

(immune-mediated brain
inflammation + demyelination)
After 2-30 days post disease
1/1000 cases / infants
1-2/1.000.000 post vaccination
MR 5% children; 25% adults

**SSPE (subacute sclerosing
encephalitis)**

virus persistence & mutation
6-15 years after disease
1/25.000 cases
but children <1 year 1/5000
Death within 3 years MR 100%

**Measles inclusion body
encephalitis (MIBE)**

Virus persistence
in immunosuppressed after
disease or vaccination
MR 75%

Ribavirin for treatment

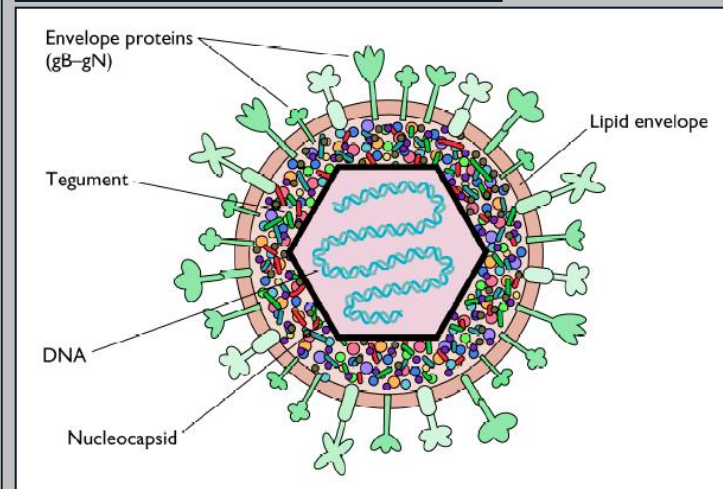
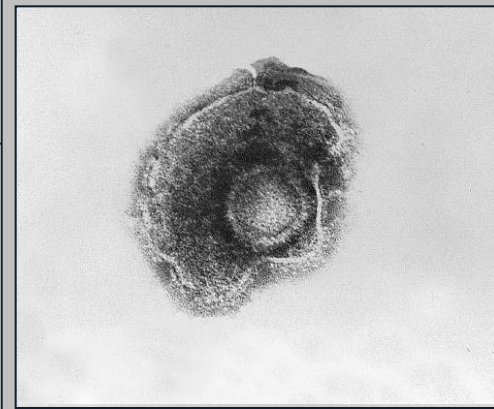
Varicella (chickenpox)

Varicella-zoster virus
dsDNA icosahedral with an
envelope
Herpesviridae family

Humans are the only reservoir
and source of infection.

VZV is highly contagious
Almost all children will be
infected by the age of 10 years

Lower prevalence in tropical
and subtropical countries



Infectious
aerosol, rash

Winter, spring

Vaccine !!!

Contagious !

VZV

10-21 days

Chickenpox

symptoms

Prodromal
Rash

Treatment
Acyclovir
VZIG

Complications

Rash - bacterial superinfection

Pneumonia

Neurologic disorders: encephalitis,
cerebellar ataxia, Guillain-Barre

Other: hepatitis, arthritis, etc.

Fetus deformation

recovery

Zoster
shingles

reactivation

Contagious !

Latency
dorsal root nerve
ganglia

Chickenpox

Infectivity 2 days
before rash



Infectivity

macules - papules - vesicles - pustules - crusts

Incubation
2-3 weeks



Clinical course: generally mild in children

Infection

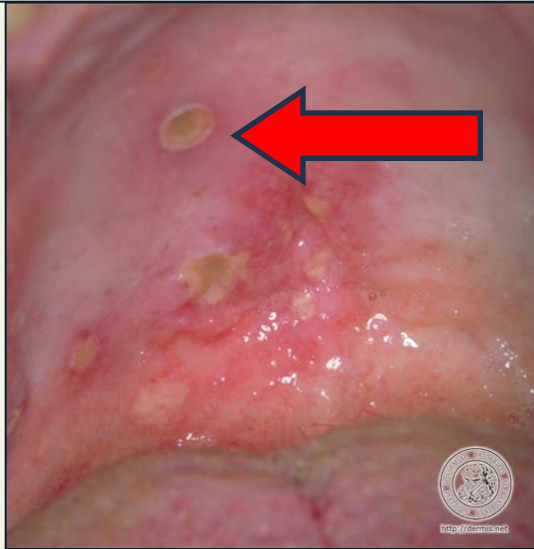
Rash: scalp, face, trunk

Infectious
aerosol
Direct contact
Vertical

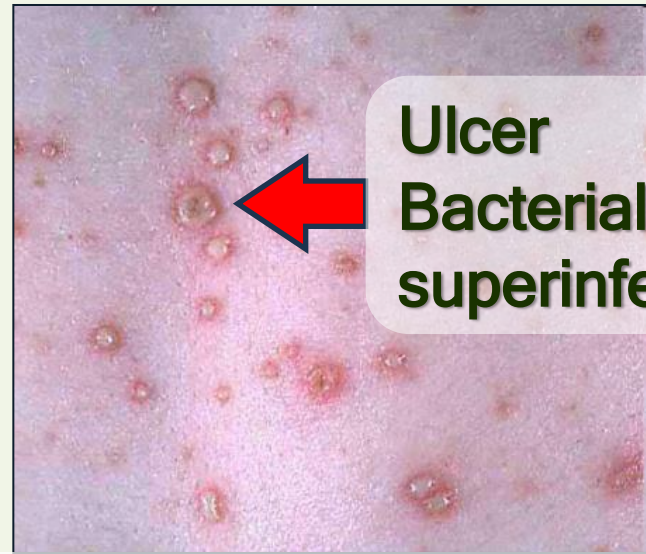
Content
of blisters



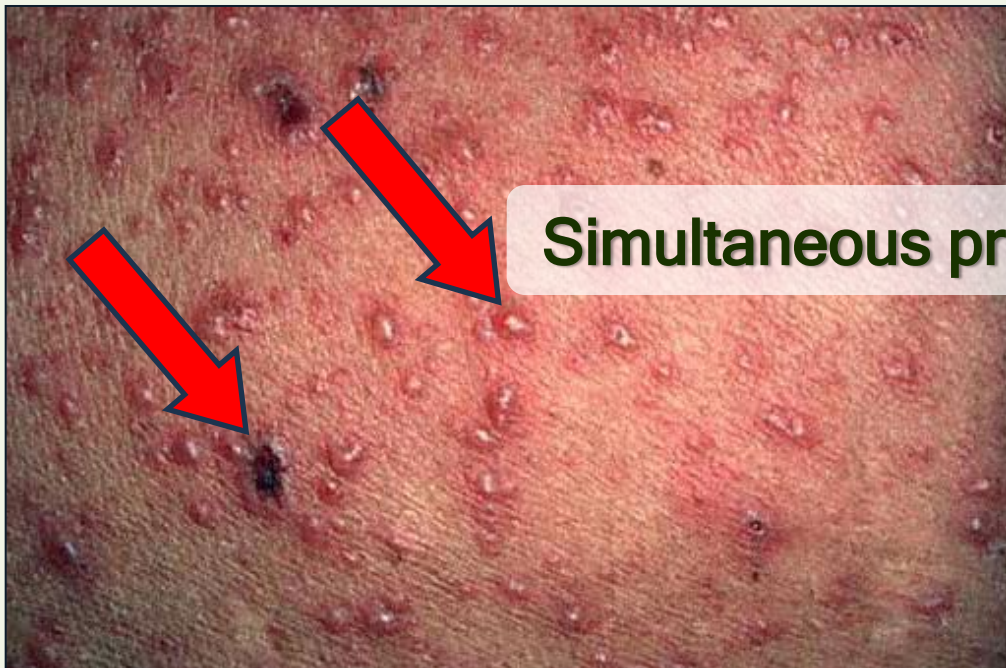
Varicella (chickenpox)



Rash on mucosal surfaces



Ulcer
Bacterial
superinfection



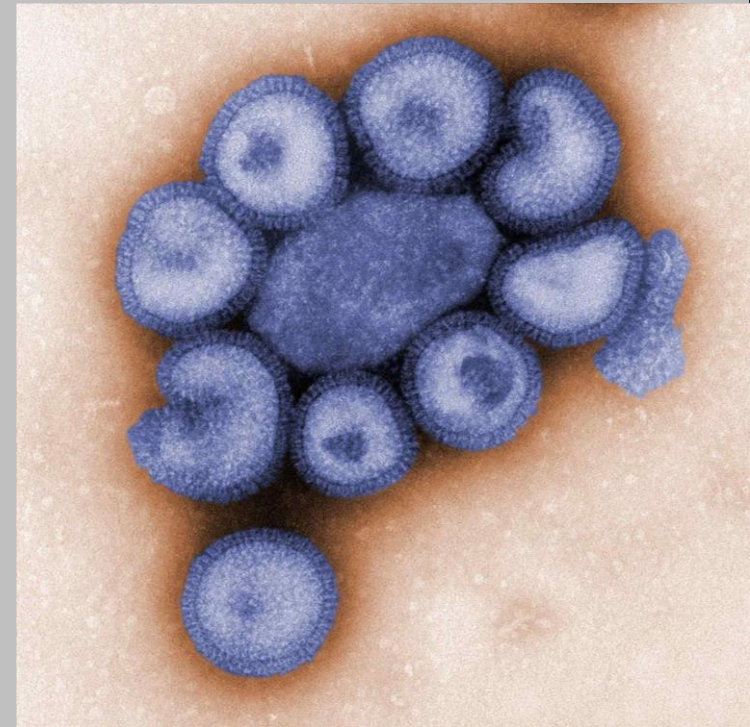
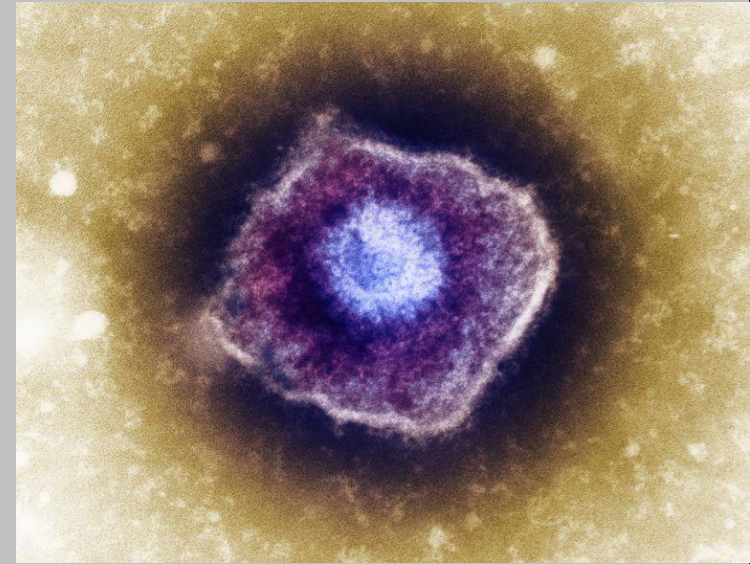
Simultaneous presence of vesicles and scabs

Latency

- Pathogenic virus lies dormant (latent) within a cell - does not replicate

Viral DNA as an episome in the Cell or integrated with the host cell DNA

Result: the virus can reactivate and replicate



Hair shaft

Initial stage consists of burning pain and sensitive skin

Weakened immune system reawakens virus

Dormant Varicella virus

Nerve fiber

Skin surface

Blisters develop resembling chicken pox and fill with pus

Blisters eventually burst, crust over and heal

Nerve damage can cause postherpetic neuralgia

Varicella (shingles)

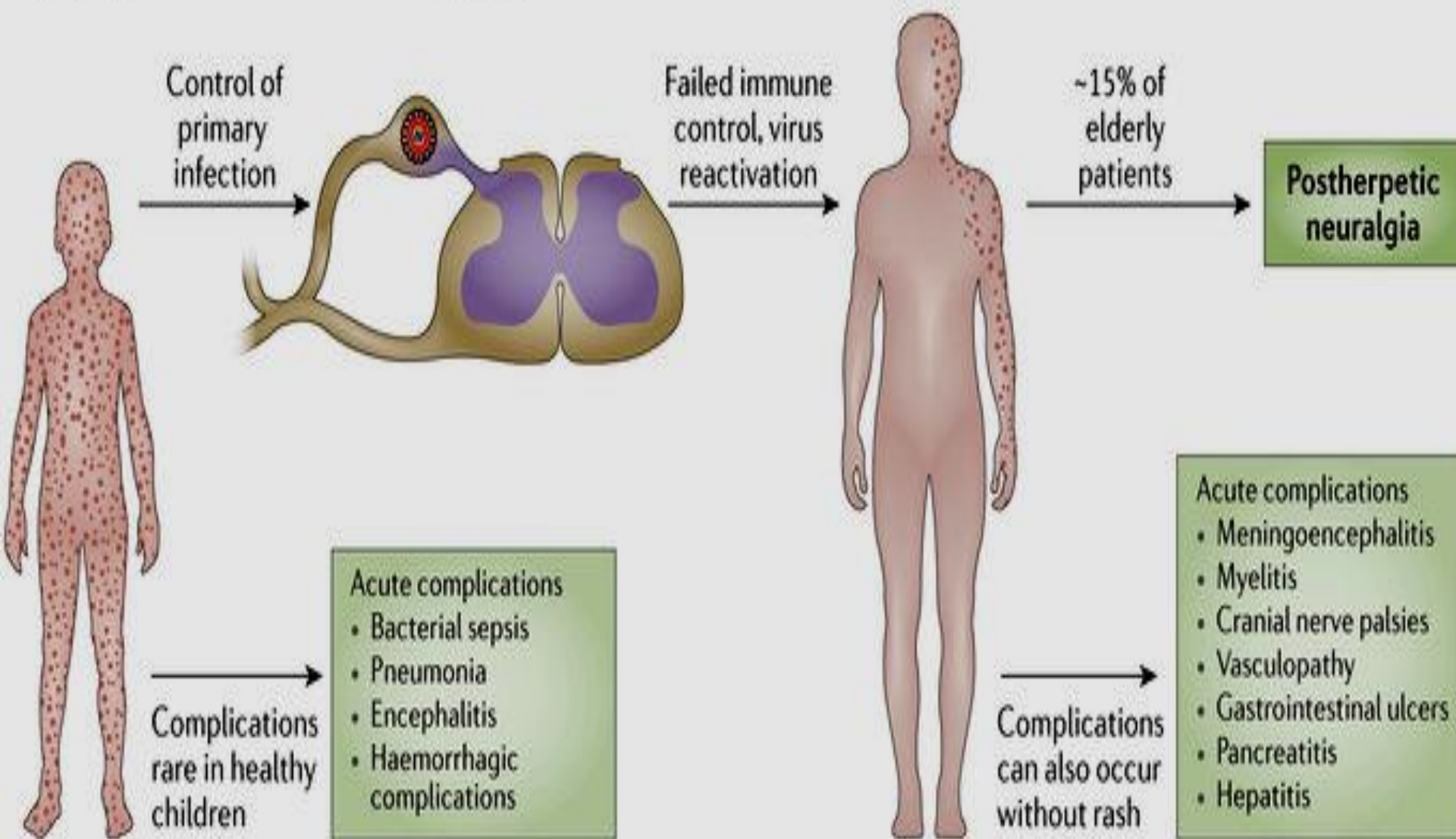
- Reactivation of chickenpox
- Less common in children than in adults



Varicella

Latency

Zoster



VZV risk of maternal infection during pregnancy

The risk of the mother passing VZV onto her baby is extremely low

If the mother contracts chicken pox - there is a 2% chance that the baby will develop congenital varicella syndrome (CVS)

Most CVS cases - mothers infected between 13- and 20-weeks gestation

Maternal shingles are not associated with CVS

The fetal risk associated with maternal varicella include development of:

- **congenital varicella syndrome**
- severe varicella in infant
- occurrence of zoster in infancy or early childhood

Factors influencing: timing of maternal varicella regarding gestation



Congenital VZV infection

Scarring skin lesions	100%
hypoplasia or aplasia of limbs	68%
low birth weight	82%
damage to the eyes	68%
neurological disorder	77%
retarded psychomotor development	50%



Horner's syndrome refers to a constellation of signs produced when sympathetic innervation to the eye is interrupted



Maternal varicella in the period around the expected birth date

The clinical course of the infection in the neonate depends on the time of transmission (intrauterine or postnatal) and the presence or absence of maternal VZV-specific antibodies

Transplacental transmission in the case of maternal viremia can lead to a high inoculum in the absence of maternal antibodies



VZV prevention

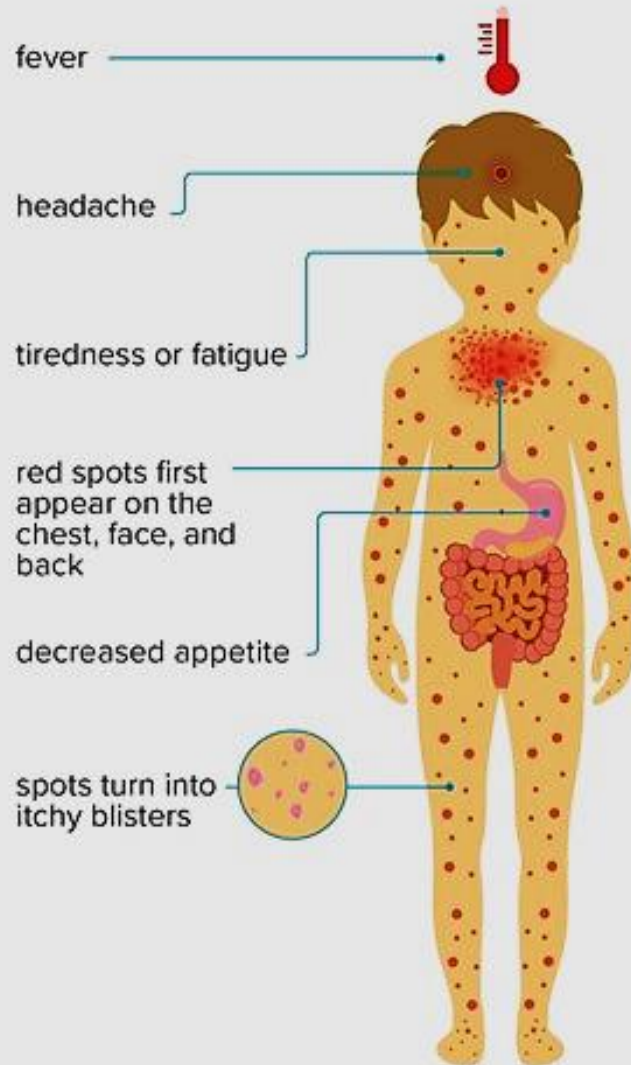
VARIVAX, VARILRIX vaccine for the prevention of chickenpox in non-immunized children and adults

ZOSTAVAX vaccine for the prevention of shingles
designated to elicit an immune response in adults whose immunity to VZV wanes with advancing age

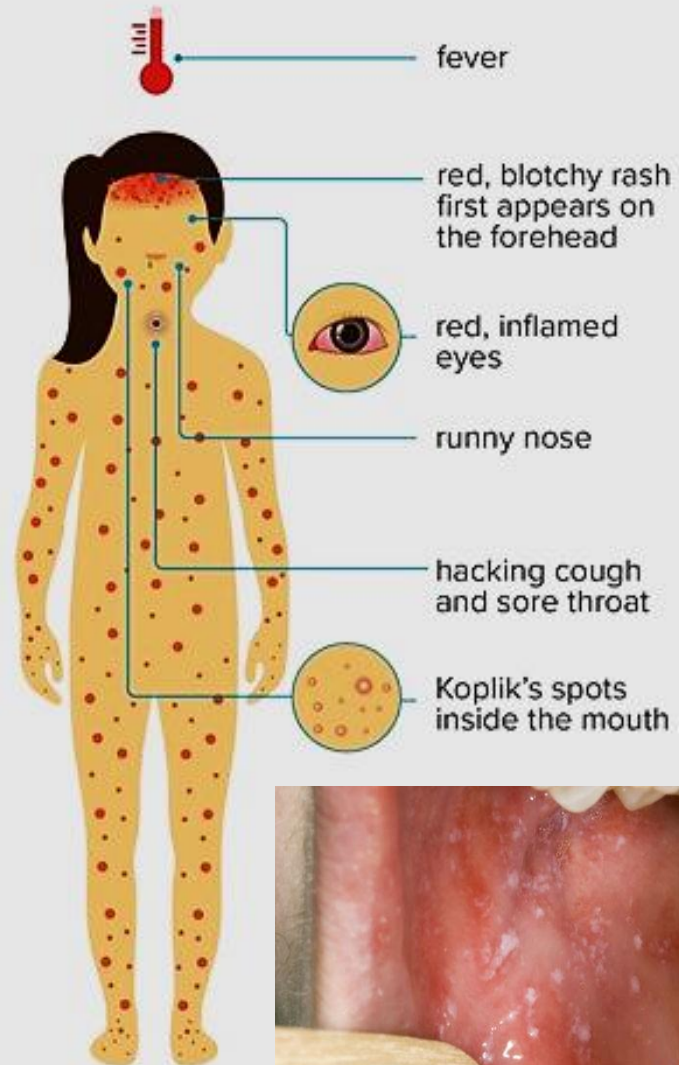
Reduces the incidence of shingles by almost 50%

Chickenpox vs. Measles

Chickenpox



Measles



Winter, spring

Infectious
aerosol

Parvovirus
B19

4-28 days

**Erythema
infectiosum**

Slapped check
disease
Self-limiting



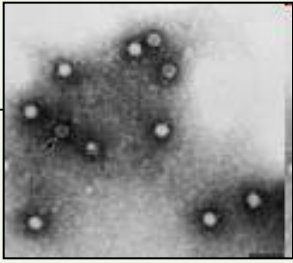
Treatment
No specific
No vaccine

Pregnant women
Hydrops fetalis

Miscarriage, stillbirth



Erythema infectiosum



Seroprevalence increases with age: 15-60% by age 5-9

Transmission:

- respiratory droplets,
- vertical (from mother to fetus)

The most characteristic feature of the disease is the prominent red rash on the face followed by a generalized rash



Parvovirus B19

- ssDNA, a nonenveloped virus of the Parvoviridae family
- Parvovirus B19 can easily overcome the placental barrier
- Embryocidal - destroys the dividing cells
- Incidences of intrauterine infection - unknown

Clinical presentations of symptomatic infection:

- erythrema infectiosum, arthropathy, hematological complications (congenital anemia), hydrops fetalis, fetal death
- congenital abnormalities: neurological, cardiac, ophthalmological, myocarditis, vasculitis



Slapped cheek disease



Throughout the
year

Life-long latency

Infectious
aerosol, saliva

HHV-6
HHV-7

3-6 days

Roseola infantum
Exanthem subitum

symptoms

Target host
cells:
CD4+

Children
Rash, CNS
irritability, digestive,
convulsions

Treatment
ganciclovir

Immunosuppressed
Brain & bone
marrow infections

Adults/reactivation
Mononucleosis-like
syndrome, hepatitis,
chronic fatigue
syndrome, atypical
polyclonal
lymphoproliferation

Infectious
aerosol, direct
contact

Winter / spring

MMR vaccine

Mumps virus

16-18 days

MUMPS

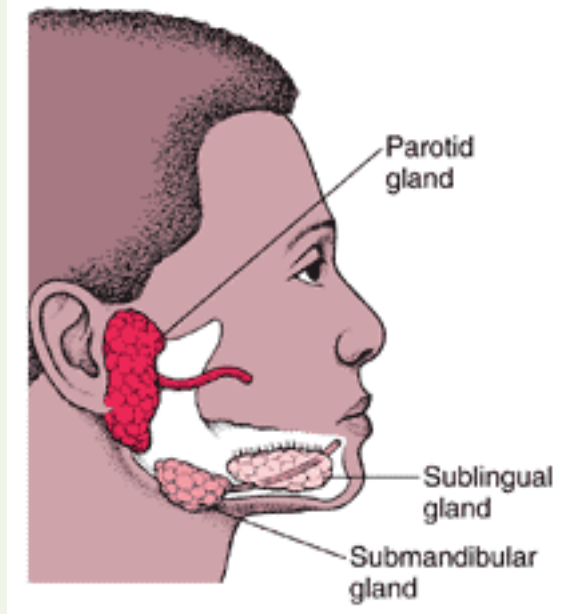
symptoms

20% no
symptoms

50% respiratory
symptoms

60% parotid salivary
glands swelling

10% submandibular
salivary glands swelling



Complications:

Meningitis, encephalitis,
orchitis, pancreatitis, acute
unilateral deafness, arthritis
**In adults the disease is more
severe**

summer / fall

direct contact
air-borne

Coxsackie A16,
(rare: Coxsackie A6,
enterovirus A71)

3-7 days

**Hand Foot Mouth Disease
HFMD**

symptoms

**Rash on palms, soles,
in mouth, low grade
fever
Lasts 7-10 days**



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Dermatology
Phone: (+44) 131 66 2727

spring

Air-borne route

MMR vaccine

Rubivirus

12-23 days

Rubella

symptoms



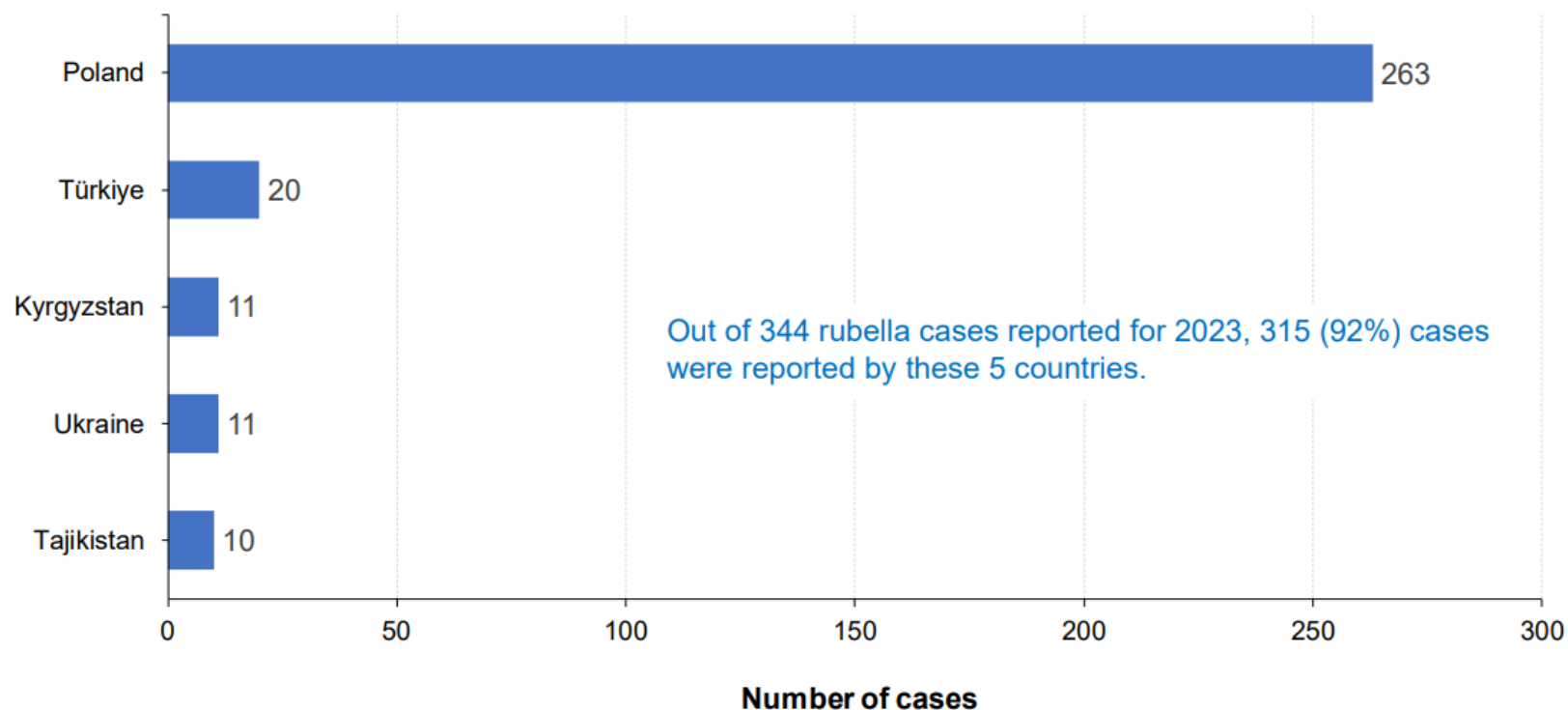
**Rash - face,
generalized**

Complications benign & rare:
Arthritis, encephalitis, orchitis,
neuritis

Congenital disease



Five countries with the highest numbers of rubella cases— WHO European Region, 2023



Congenital rubella syndrome



Rubella virus (RBV)

- RNA virus, member of Togaviridae family
- Rubella = German measles or 3-days measles - mild, self-limited infection
- Primary rubella infection during pregnancy - fetus death, miscarriage, congenital abnormalities

RBV - Risk of congenital infection

Intrauterine transmission of rubella occurs during viremia in the mother

Women without preexisting immunity are at risk for congenital infection

Reinfection during pregnancy - risk of fetal infection very low

Microcephaly

Congenital rubella

Heart disease

Petechiae and
purpura



Classical triad of congenital rubella

Cataract

Cardiac abnormalities

Deafness

Eye anomalies may include cataracts, glaucoma, strabismus, nystagmus, microphthalmia, and iris dysplasia.



Risk of congenital infection (RBV)

- The rate of infection in infants whose mother had exposure **before 11th week of gestation** = **about 90%**
- Maternal infection during **II & III trimester**: the rate of infection in neonates - **39% & 53%**
- Risk for defects in neonates infected during the first trimester - very high (85%)
- Risk for defects in neonates infected during the 2nd & 3rd trimester - 20% & 5%

RBV - congenital infection

Intrauterine infection with rubella can affect any organ system & infants often have multiple organ involved

Spectrum of clinical abnormalities: ophthalmological (cataracts, retinopathy, congenital glaucoma), cardiac (patent ductus arteriosus), auditory, neurological (meningoencephalitis, microcephaly)

RBV - congenital infection



Teratogenic agent

An agent that causes developmental defects during pregnancy through a direct effect on the embryo or fetus (this includes severe abnormalities that may lead to embryonic or fetal death)

TORCH: **T**oxoplasma gondii, **O**thers (syphilis, mumps, VZV, Parvovirus B19, HIV), **R**ubella virus, **C**ytomegalovirus, **H**SV

Answer questions

1. Which virus can reset the immune system of infected individuals?
.....
2. Kolpik's spots occur in (what disease?) and (where?)
.....
3. Name four childhood diseases preventable by vaccination: a)
b), c), d)
4. In measles, the rash first occurs on, whereas in chickenpox on
5. Fetal edema and severe anemia develop in the infection of pregnant women with (what virus?)
6. Scaring skin lesions and limb hypoplasia occur in children born by mothers with primary (what?)infection
7. HFMD presents with (what type of rash?), and is caused by (what virus?)
8. Salivary glands swelling is specific to (what?) caused by (what virus?)



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