



# RESPIRATORY TRACT INFECTIONS

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# Viral respiratory infections

50 - 70% of all respiratory infections. They occur on average twice a year for adults and up to 5 times a year for children.

Rhinoviruses

Orthomyxoviruses A,B,C (Influenza)

Paramyxoviruses

Adenoviruses

Coronaviruses

Reoviruses

Enteroviruses



# INFLUENZA

## Etiology:

### ORTHOMYXOVIRUSES - INFLUENZA VIRUSES A,B,C (D)

The body enter is the mucous membrane of respiratory tract.

The incubation time for seasonal influenza is on average two days, but ranges from one to four days.

Source is the human from the end of incubation period to 5. days after the onset of the symptoms.

The replication of the viruses in the epithelial cells of the respiratory tract is very prompt after cca 4 hours with maximum the first 2 – days

The matured viruses consequently attack a other susceptible cells; cells decay – the beginning of fever.

On average an infectious person will infect less than two non-immune people.

Influenza spreads:

- \* predominantly via the droplet and contact routes when people cough and sneeze,
- \* and by indirect spread through respiratory secretions on hands, tissues, etc.

If the infected person doesn't cover his or her mouth and nose people within a range of two meters can be infected. There is also some evidence that infectious aerosols may play a role in influenza transmission.

However, immunity to influenza viruses and vaccines wane over time and a large part of the population is susceptible each season.

## The source of infection

## Route of transmission

## Susceptibility

# ORTHOMYXOVIRUSES - INFLUENZA VIRUSES

Influenza virus type A was first cultivated in the 1930s. Thus this agent was first of the respiratory viruses to be cultivated in the laboratory.

There are three major antigenic types –A,B,C – based on antigenic differences between their nucleocapsid and matrix proteins.

Subtypes differences are based on antigenic differences in the hemagglutinin (HA) and neuraminidase (NA) surface proteins.

The segmented genome of influenza viruses is a key features that allows for the genetic reassortment and creation of major antigenic changes (antigenic drift and shift) seen with influenza A viruses.

# ORTHOMYXOVIRUSES - INFLUENZA VIRUSES

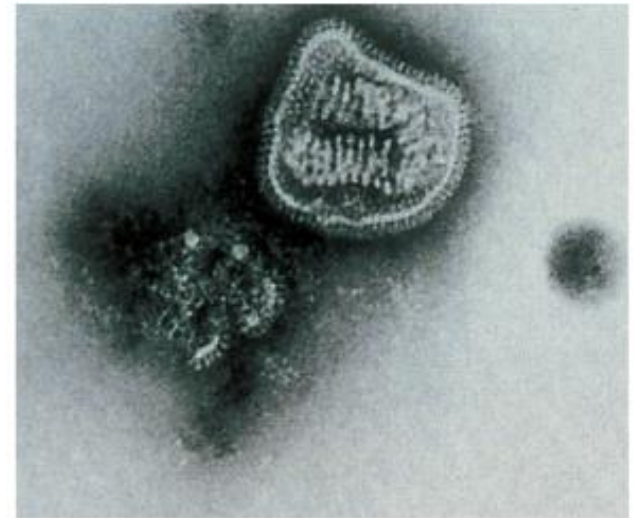
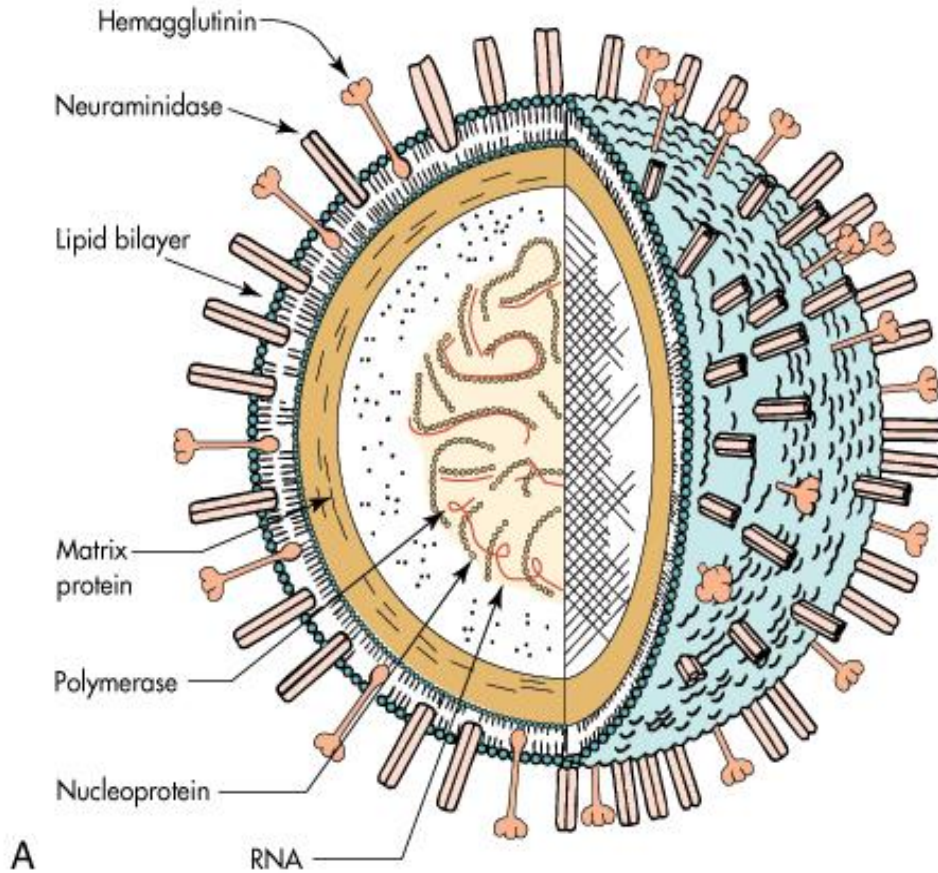
Antigenic shift involving the HA protein are critical because antibodies to this surface glycoprotein are associated with neutralization of viral infectivity. The generation of genetic reassortments in animals (e.g. duck) that are co-infected with human and animal influenza viruses is a proposed mechanism for antigenic shifts that led to the emergence of pandemic disease.

A outbreak of avian influenza A (H5N1) in Hong Kong yielded isolates with exclusively avian genomes. In this case as well transmissibility of these isolates was minimal.

A recent outbreak of „pigs“ influenza A was H1N1.

Minor antigenic changes (antigenic drift) occurs as the results of mutation in the surface HA and NA proteins, which provide a means for the virus to escape existing immunity.

# Schema

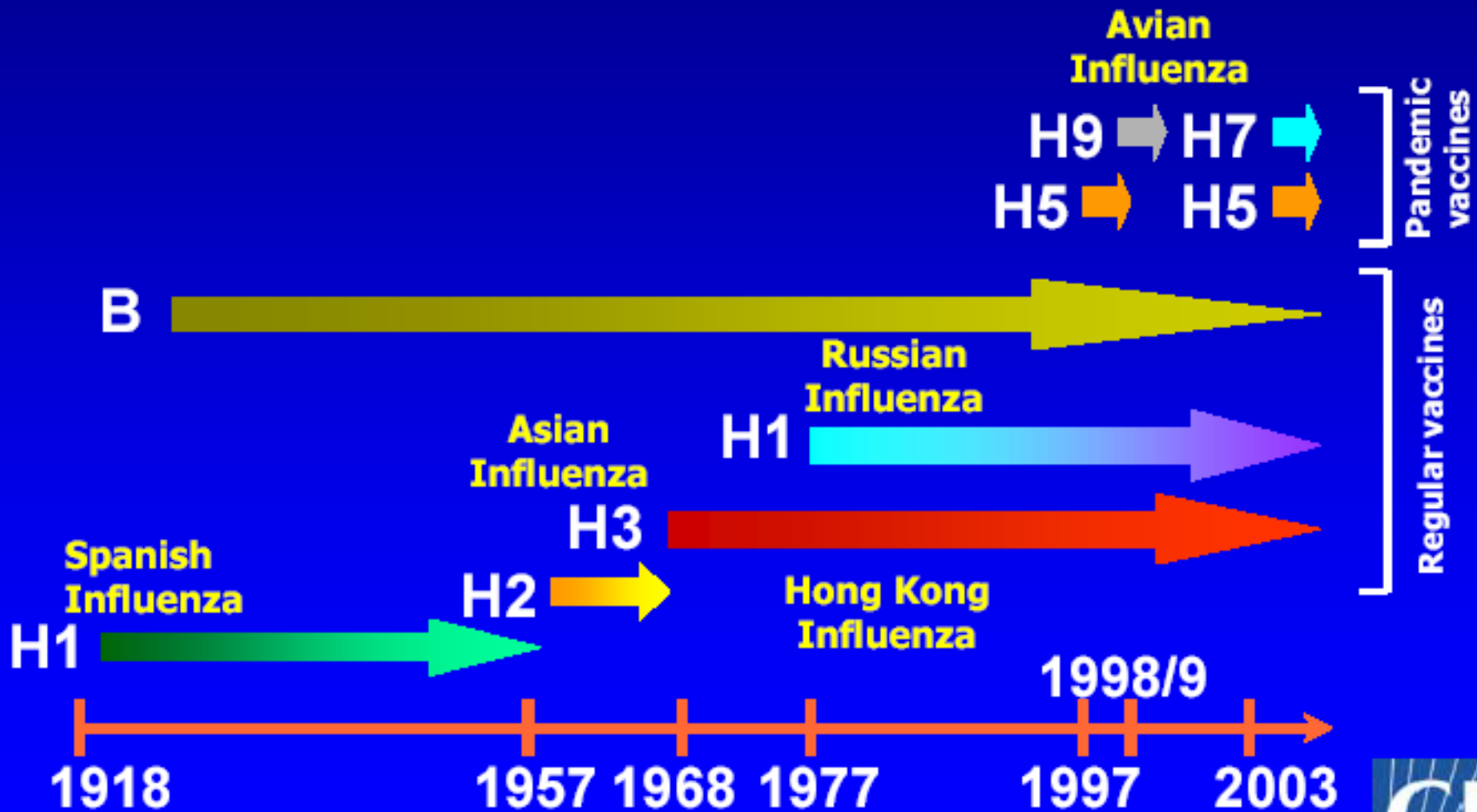


# History

- From the 17. and 18. century are reports about the epidemics in the towns and viliges too.
- Consecutive some epidemics afflicted all continents except Austrálie
- „archeologic sérology“ detected:
  - A (H2N2) in the 1889-1892 and
  - A (H3N8) in the 1898-1901
  - A (H1N1) in the 1918-1920 – „Spanish flu“



# Incidence subtypes Flu A at human population (CDC)



# SPREAD OF H2N2 INFLUENZA IN 1957 "ASIAN FLU"



# ORTHOMYXOVIRUSES - INFLUENZA VIRUSES

## Epidemiology:

Influenza is an a seasonal virus that infects all age groups.

Influenza type A is the most clinically important, followed by types B and C.

Influenza B infection is associated with the same disease spectrum as influenza A but infuenza B infection has a lower association with severe disease and hospitalization.

Although most people appear to have experiend influenza type C infection by early adulthood, this agentsis associated with mild sporadic upper respiratory tract infections and is rarely associated with lower respiratory tract disease.

- The source – is the human from the end of incubation period to 5. days after the onset of the symptoms.
- The body enter is the mucous membrane of respiratory tract
- The replication of the viruses in the epithelial cells of the respiratory tract is very prompt after cca 4 hours with maximum the first 2 – days
- The matured viruses consequently attack a other susceptible cells; cells decay – the beginning of fever
- After 5. days is very difficult the isolation of viruses



# Epidemiologie

- ***The reasons of explosive spreading:***
  - ✓ High infectivity - low infectious dose
  - ✓ Short the incubation period
  - ✓ Fast replication of the virus
  - ✓ General susceptibility of the population

# Risks groups of people

- Old people - more than 65 years
- Patients with chronic diseases of lung (CHOPN, bronchial asthma, cystic fibrosis)
- Chronic diseases of liver or decreased function of kidney
- Metabolic diseases (DM)
- Neutropenia, malignant processes, defects of immunity (HIV +, after transplantation, chronic immunosuppression)

# Diagnostics

- Routine laboratory diagnostics for influenza are usually performed **by detecting the virus antigen or genome** in specimens from the respiratory tract. Sampling can e.g. consist **of swabbing the nose and nasal cavity**.
- The tests performed in laboratories include **RT-PCR**, **enzyme-linked immunoassay**, **immunofluorescence**, and **virus culture**. Except for virus culture these results can be available within approximately 1-2 days, and can help adjust the treatment.
- There are also rapid point of care tests (quick test) that require less time. However these tests generally have a low sensitivity but high specificity, and do not allow subtype determination.

# Therapy

- Mainly symptomatic
- By the risks patients – *antivirotics*
- Application in the first two days:
  - 1. generation ***amantadin a rimantadin*** ⇒ effectivity only by the influenza types A
  - 2. generation ***zanamivir*** (inhalation) and ***oseltamivir*** (p.o.) ⇒ effectivity for types A i B.

For the best clinical benefit, treatment with antivirals should be given early in the infection, **within 48 hours**, (the earlier the better).



# Types of the vaccine

celovirionové vakcíny



obsahují kompletní viry

vakcíny typu „split“



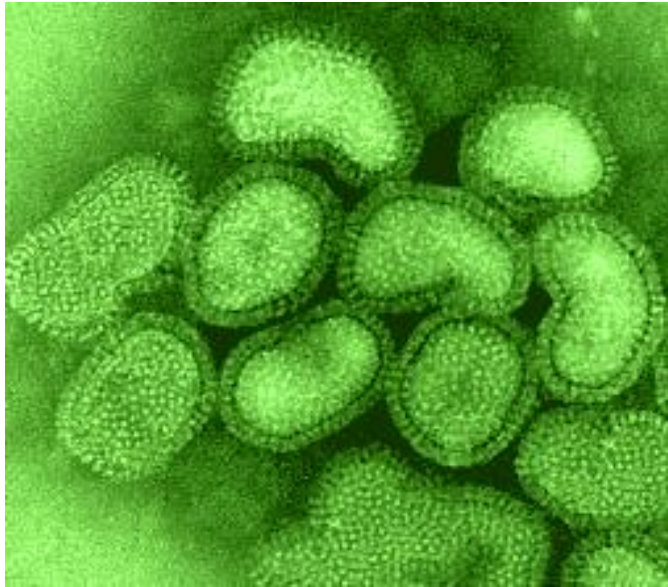
obsahují virové částice ve  
vysoce purifikované formě

subjednotkové vakcíny



obsahují pouze purifikované  
HA a NA antigeny

# Influenza and H5N1



Fifteen subtypes of influenza virus are known to infect birds, thus providing an extensive reservoir of influenza viruses potentially circulating in bird populations.

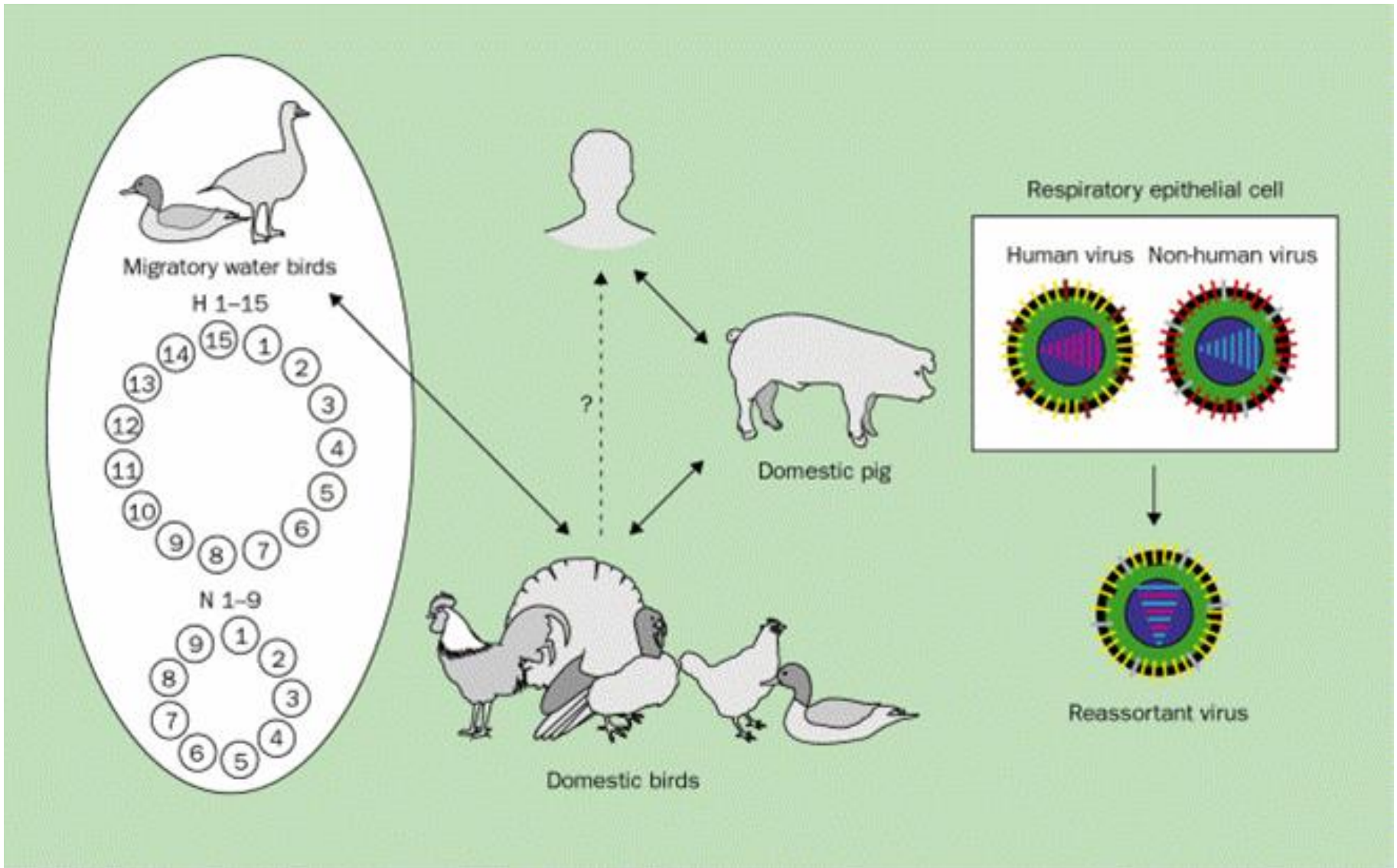
To date, all outbreaks of the highly pathogenic form have been caused by influenza A viruses of subtypes H5 and H7.

Within a country, bird flu can spread easily from farm to farm. Large amounts of avian flu is secreted in bird droppings, therefore contaminating dust and soil. An airborne virus can spread bird flu from bird to bird, causing infection when the avian flu is inhaled.



Bird flu viruses do not usually infect humans, however, several cases of human infection with bird flu viruses have occurred since 1997.

# The rise of the pandemic strain



# Interhuman transmission ?





# Farm by Hanoi, 2002 (CDC)







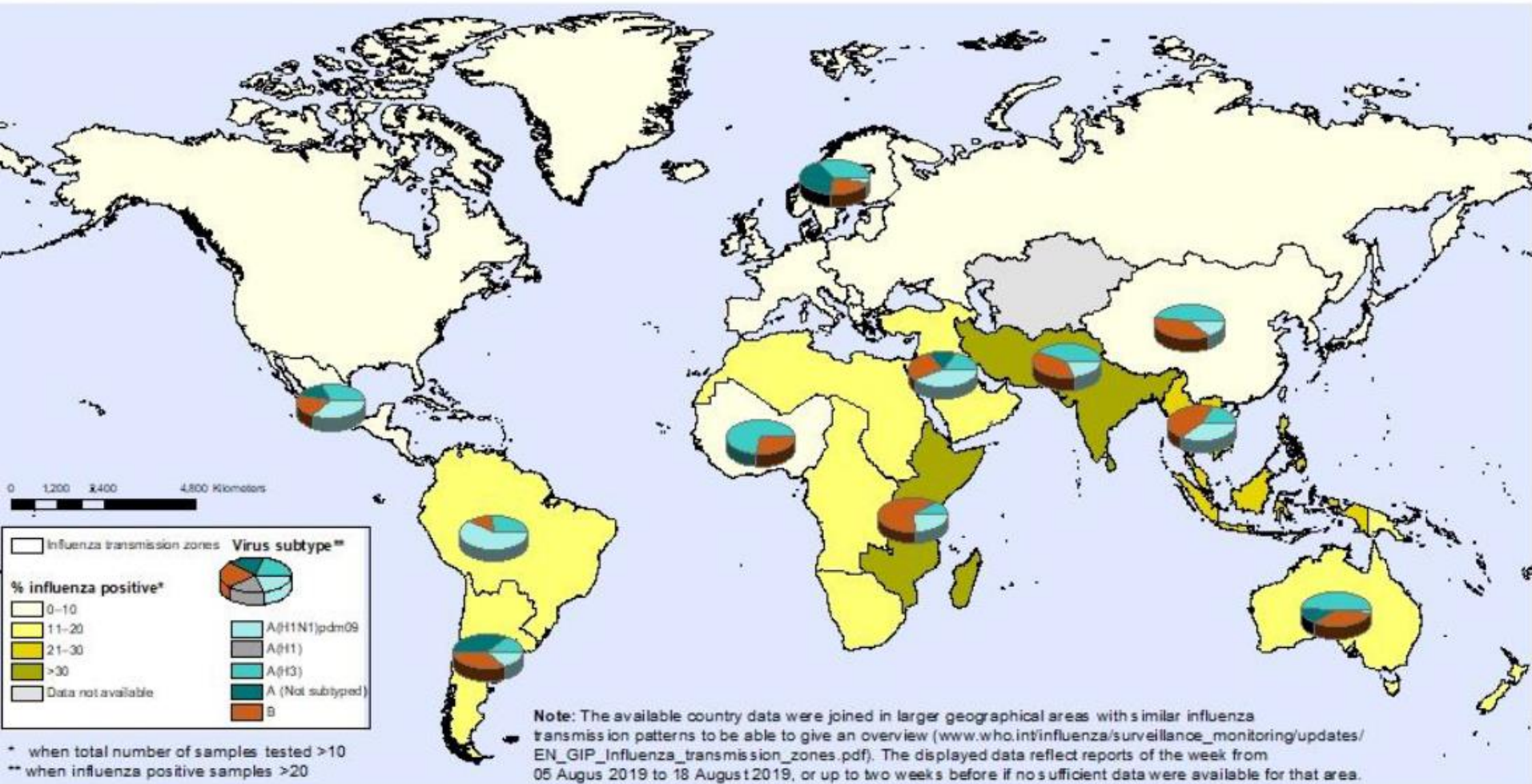






# Percentage of respiratory specimens that tested positive for influenza By influenza transmission zone

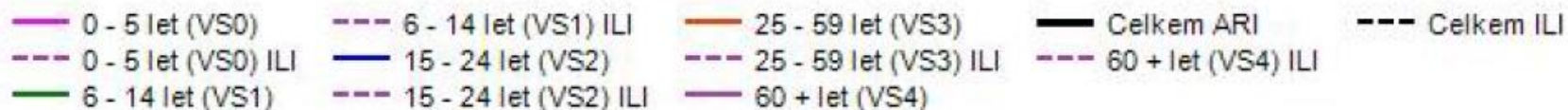
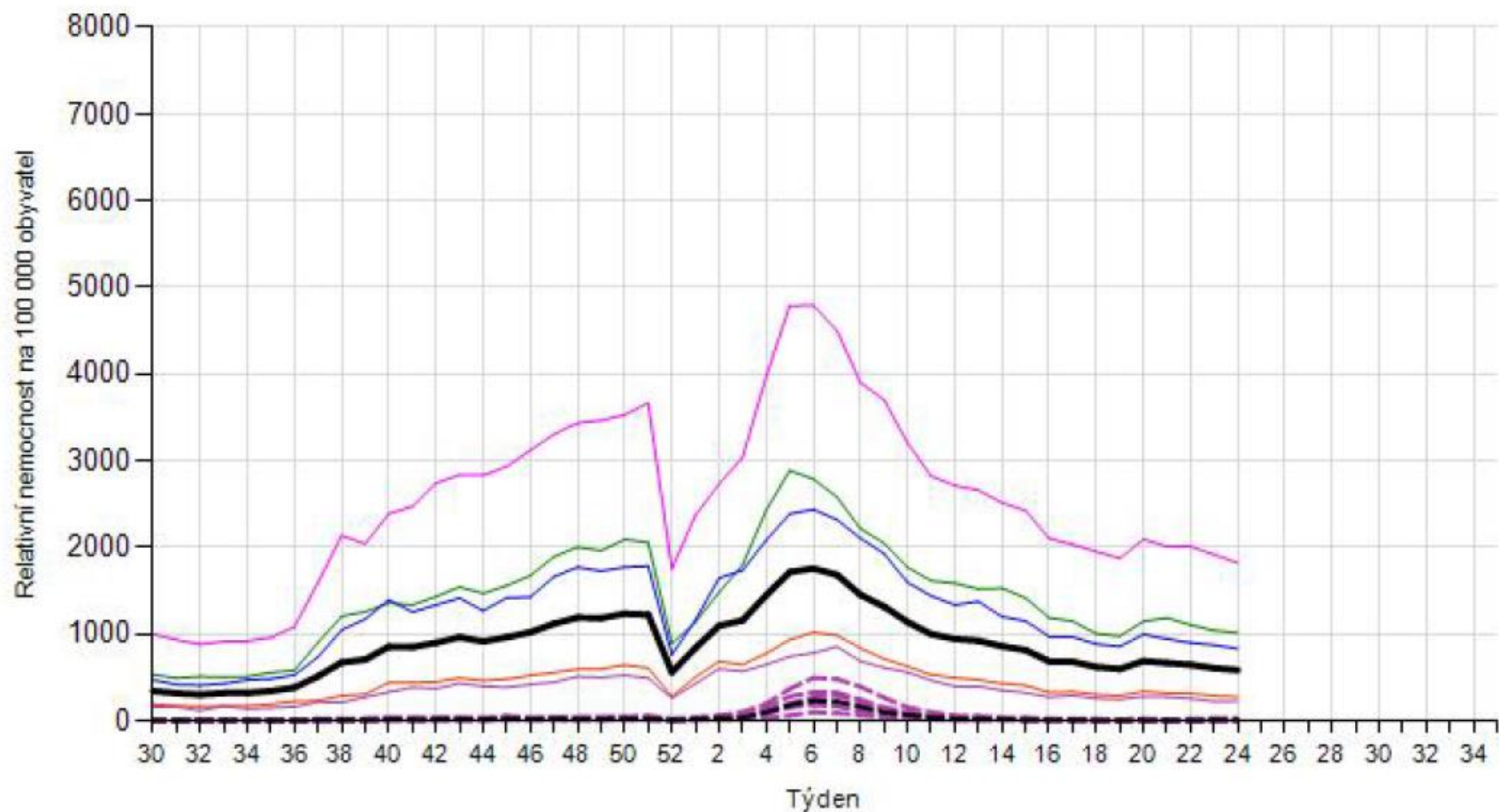
Status as of 30 August 2019



The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

Data Source:  
Global Influenza Surveillance and Response System (GISRS),  
FluNet ([www.who.int/flu-net](http://www.who.int/flu-net))

## Hlášení ARI / ILI - ČR, sezóna : 2018 / 2019



	0-5	6-14	15-24	25-59	60+
A	2/119 (1,7 %)	2/181 (1,1 %)	0	1/148 (0,7 %)	1/68 (1,5 %)
B	0	0	1 /63 (1,6 %)	2/148 (1,4 %)	3/68 (4,4 %)
A/H1	19/119 (16,0 %)	43/181 (23,8 %)	4/63 (6,3 %)	26/148 (17,6 %)	8/68 (11,8 %)
A/H3	4/119 (3,4 %)	10/181 (5,5 %)	2/63 (3,3 %)	4/148 (2,7 %)	3/68 (4,4 %)
HRV	22/119 (18,5 %)	24/181 (13,3 %)	13/181 (20,6 %)	21/148 (14,2 %)	11/68 (16,2 %)
RSV	19/119 (16,0 %)	3/181 (1,7 %)	2/63 (3,3 %)	11/148 (7,4 %)	8/68 (11,8 %)
ADV	5/119 (4,2 %)	11/181 (6,1 %)	3/63 (4,8 %)	3/148 (2,0 %)	0
PIV	7/119 (5,9 %)	6/181 (3,3 %)	2/63 (3,3 %)	8/148 (5,4 %)	4/68 (5,9 %)
COV	5/119 (4,2 %)	10/181 (5,5 %)	3/63 (4,8 %)	12/148 (8,1 %)	2/68 (2,9 %)
MPV	2/119 (1,7 %)	5/181 (2,8 %)	1/63 (1,6 %)	0	1/68 (1,5 %)
BOCA	3/119 (2,5 %)	0	0	0	0
SM	12/119 (10,1 %)	7/181 (3,9 %)	1/63 (1,6 %)	5/148 (3,4 %)	3/68 (4,4 %)
NEG	19/119 (16,0 %)	60/181 (33,1 %)	31/63 (49,2 %)	22/148 (35,2 %)	24/68 (35,2 %)

**A set of 579 sentinel patients:**

HRV - humann rhinovirus

RSV - resp. syntic. virus

ADV - adenovirus

PIV - parainfluenza virus

COV - coronaviruses

MPV - metapneumovirus

BOCA - bocavirus



**Quadrivalent combination vaccines containing:**

- \* **two influenza A strains (H1N1 and H3N2 subtypes) and**
  - \* **two influenza B strains (Victoria and Yamagata lineages)**
- as per WHO recommendations.**

- **Injected quadrivalent inactivated** influenza vaccines, available from the 2014/2015 season in some EU/EEA countries
- In 2011, a **live attenuated** influenza vaccine (LAIV) for intranasal use was approved in the EU/EEA for children and adolescents (2-17 years of age).

Most influenza vaccines, both inactivated and live attenuated, are based on production of influenza viruses/antigens in fertilised hens' eggs. These vaccines can therefore not be given to egg-allergic individuals developing severe symptoms upon exposure to egg proteins.

Hence, a few manufacturers have developed **cell-based influenza vaccines** which can be given to severely egg-allergic individuals.

# Risk groups for severe influenza

## Older adults - cca 65 yers

**All persons (over six months of age) with chronic medical conditions:**

- respiratory system e.g. asthma
- cardiovascular system e.g. coronary artery disease
- endocrine system e.g. diabetes
- hepatic system e.g. liver cirrhosis
- renal system e.g. chronic renal failure
- neurological/neuromuscular conditions e.g. parkinsonism

## **In addition to the above:**

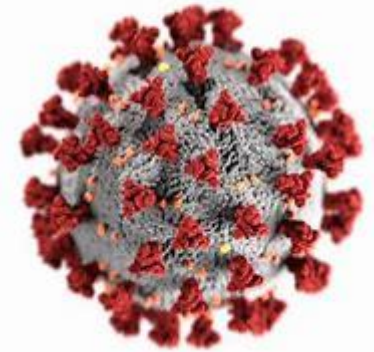
- any condition compromising respiratory functions e.g. morbid obesity (BMI > 40), physical handicap in children and adults
- immunosuppression due to disease or treatment including due to haematological conditions and HIV infection

From 2012 --- new group - pregnant women

- health care workers with patient contact.

# COVID 19

Novel Coronavirus  
(COVID-19)

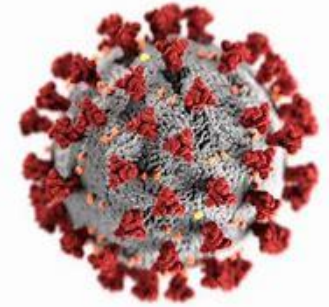


A new type of coronavirus from the group of **enveloped RNA viruses**.

- Currently known 7 human species (Alpha-, Beta-, Gamma-,Delta)
  - \* Alpha- and Beta-coronaviruses mostly infect mammals.
  - \* Gamma- and Delta-coronaviruses infect birds and mammals, it has not been a case of human infection has been reported.
- Alpha- and Beta-coronavirus infections are common in humans diverse clinical picture from the common cold to after severe infection (incl. pneumonia).
- Three new zoonotics have appeared in the last twenty years coronaviruses that cause disease in humans:
  - SARS-CoV in 2002
  - MERS-CoV in 2012
  - SARS-CoV-2 in 2019 (originally designated 2019-nCoV),

# COVID 19

Novel Coronavirus  
(COVID-19)



**Source:** At present, the source of the disease is man.

- The primary source of the new coronavirus has not yet been identified; the source will probably be an unspecified animal.
- It is likely that the first cases of the disease is responsible animal resource / reservoir from Wuhan Market.
- Similarly, others have been transferred to the human population coronaviruses, SARS virus through small carnivores from civet family and MERS virus via one-humped camels.
- There is growing evidence of a possible link between SARS-CoV-2 and other similar known coronaviruses that circulate among bats.

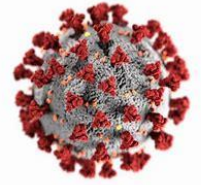
**Transmission:** Droplet transfer

- close contact (within 1 meter) with an infected person through infectious secretions such as saliva and respiratory secretions or their respiratory droplets, which are excreted when coughing, sneezing, speaking or singing.

Respiratory droplets are larger than 5-10 on average micron

- Infectious aerosol dissemination - droplets smaller than 5 microns, float longer in the environment time at a greater distance (specifics in health.)
- Contaminated surfaces

**Susceptibility:** general



# COVID 19

## Global epidemiological situation

The incidence of new COVID-19 cases has continued to accelerate, while the incidence of new deaths has remained relatively stable.

As of [18 Oct 2020], over **40 million cases** and **1.1 million deaths** have been reported globally, with over 2.4 million new cases and 36 000 new deaths reported over the past week.

**The European Region** has continued to report a rapid increase in cases and deaths, with over 927 000 new cases reported this past week -- a 25% weekly increase in cases compared to the previous week -- contributing 38% of all new cases reported worldwide.

Similarly, the number of deaths continues to climb with a 29% increase from last week.

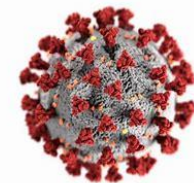
Increases, although more gradual, were also observed in the African, Eastern Mediterranean, and Western Pacific Regions. Declines continued to be reported in the Region of the Americas and the South East Asia Region; although the incidence of new infections remains high, and collectively these 2 regions contribute over half of new cases and deaths observed globally.

The countries reporting the highest number of cases in the past week remain the same as last week: India, the United States of America, France, Brazil, and the United Kingdom.



# Risks groups of people

- Old people - more than 70 years
- Patients with chronic diseases of lung (CHOPN, bronchial asthma, cystic fibrosis)
- Patients with cardiovascular diseases
- Neutropenie, malignant processes, defects of immunity (HIV +, after transplantation, chronic immunosuppression)
- Men in these groups are at higher risk than
- women.



# COVID 19

## - African Region

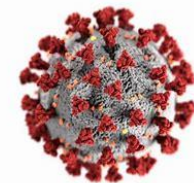
Continuing trends in the previous week, the Region reported an increase in both cases and deaths in the last 7 days, with an 11% increase in new cases and an 8% increase in new deaths (Figure 3). The pattern of increasing cases continues to be driven by South Africa and Ethiopia, with Kenya, and Botswana also reporting notable increases.

The majority of countries in the region are reporting community transmission of COVID-19 (n=39; 78%), with a further 7 (14%) classifying transmission as clusters of cases (n=7; 14%), 3 (6%) as sporadic cases, and 1 (2%) as reporting no active cases.

An unusually high number of cases was reported from Botswana this week, with over 1800 cases reported in one day. This was largely attributed to a backlog of tests administered from [2-13 Oct 2020], mostly from in and around the capital city of Gaborone.

South Africa has accounted for approximately 70% of deaths in the Region in the past week. The high number of deaths being reported is partially attributed to a mortality audit, and many of these deaths are retrospectively reported.

Mauritania reported a large increase from last week (12 to 80 cases), all reported from the capital, Nouakchott. Although this is a higher number of cases than Mauritania has reported in recent weeks, it remains lower than the daily numbers reported in July [2020].



# COVID 19

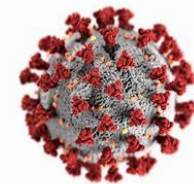
## Region of the Americas

A slight decrease in new cases was reported across the Region over the past week (Figure 4) in comparison to the previous week. The United States of America, Brazil, Argentina, Colombia, and Mexico continue to register the highest number of weekly new cases in the region, while the highest incidence of new cases per million population was reported in Argentina, Bahamas, Costa Rica, and Saint Martin, all with more than 1600 cases per million in the past 7 days. A marked decline in the incidence of deaths in the region continued this past week with just over 16 000 new deaths, compared with 20 000 new deaths last week. The Region accounts for 1/3 (n=798 794, 33%) of new cases and almost 1/2 (45%) of new deaths reported globally in the past week. Most countries and territories in the region self characterize their current transmission pattern as community transmission (n=34, 64%), with 8 (15%) classified as clusters of cases, 7 (13%) as sporadic cases, and 5 (9%) as no cases.

Argentina remains the country in the Region with the highest number of new cases and new deaths per million population with over 2000 new cases per million inhabitants in the past week. Even though the weekly incidence of new COVID-19 cases is increasing gradually, a decreasing trend in the number of new deaths has been reported in the past 2 weeks, dropping from 6000 deaths per week at the end of September [2020] to less than 2500 deaths in the past week.

Guatemala continues to register a gradual decline in the incidence of new cases, however, an 88% increase in new deaths (from 80 to 150 deaths) was reported over the past 7 days. COVID-19 test positivity rates have also remained relatively high for the last 12 weeks with over 10% of samples testing positive. The highest incidence of cases and deaths was reported in the capital, Guatemala City, and has reached over 530 deaths per million population.

Peru has the 2nd-highest rate of deaths per 1 million population in the Region with 1021 deaths per million inhabitants. However, in the last week, modest decreases in case and death rates continued. Some regions have reported declines of 50% and the regions of Puno, Madre de Dios, Amazonas, and Moquegua registered declines of 70% in the weekly incidence of COVID-19.



# COVID 19

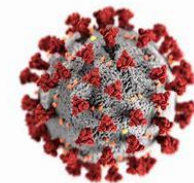
## Eastern Mediterranean Region

A gradual increase of new cases and deaths was reported by the Eastern Mediterranean Region over the past week (Figure 5), reaching the highest weekly incidence reported since the beginning of the pandemic, with almost 150 000 new confirmed cases from 22 countries. In the past week, The Islamic Republic of Iran, Iraq, and Morocco are reported the highest number of new cases while Bahrain, Lebanon, and Jordan report the highest incidence, with over 1500 new cases per million population.

A majority of the countries in the region continue to self-characterise their current transmission pattern as community transmission (n=14, 64%), with 5 countries reporting clusters of cases and sporadic cases being reported in Somalia, Djibouti, and Saudi Arabia. During the past week, Tunisia updated their classification from clusters of cases to community transmission.

The Islamic Republic of Iran remains the most affected country in the region with Tehran, the capital city, being the most affected area. In this reporting period, Iran has recorded new weekly records, with over 30 000 new cases (360 cases per million population) and over 1800 deaths (22 new deaths per million population) reported, bringing cumulative counts in the country to over 534 000 cases and 30 000 deaths.

Libya has shown a surge in cases, recording over 6000 new cases (900 cases per million population). Test positivity rates also continue to gradually increase, with approximately 1 in 4 samples tested returning a positive result.



# COVID 19

## European Region

This week, the European Region again reports the highest increase in cases and deaths thus far -- 25% and 29%, respectively compared to the previous week.

In addition, the Region reported the greatest proportion of **new cases** globally (38%, n=927 433). A media briefing by WHO Regional Director for Europe highlighted that the region is currently reporting over 3 times more cases per day compared to the April [2020] peak, with **hospital admissions rising**, although the number of daily deaths remains 5 times lower than they were in April [2020].

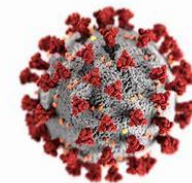
France, the United Kingdom, the Russian Federation, Czechia, and Italy continue to report a high incidence of new cases.

Collectively, these 5 countries contribute to over 1/2 of all reported cases this week in the Region.

A majority of the countries in the region self-characterise their current transmission pattern as community transmission (n=34, 55%), with a further 20 (33%) countries reporting clusters of cases, 4 (6%) [sporadic cases], 3 (less than 1%) no cases, and one pending classification. During the past week, North Macedonia updated their classification from clusters of cases to community transmission.

Slovenia reported a 150% increase in cases this week (n=4890) -- the highest one-week increase the country has experienced so far. In addition, Slovenia reported 1924 deaths, compared to only one death last week. In response to this recent increase in cases and deaths, as of [19 Oct 2020], the Slovenian government has declared a 30-day state of emergency with a daily curfew.





# COVID 19

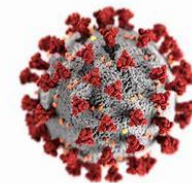
## South East Asia Region

Overall, the region continues to show a decline in cases and deaths, with Nepal being the only country which reported an increase in both new weekly cases (12%) and new deaths (31%) in comparison to the previous week. Nepal reported 810 new cases per one million population, the highest in the region, followed by the Maldives (590) and India (319). Most countries in the region self-characterise their current transmission pattern as cluster of cases (n=6, 55%), with 2 countries reporting community transmission, and a further 2 reporting sporadic cases.

Bangladesh reported an 8% increase in new weekly cases. Among the 386 086 cases reported as of [16 Oct 2020], the majority (81%) were adults aged 21-60 years, and almost three-quarters (72%) were male. During the same timeframe, the country has conducted 2.13 million diagnostic tests or 12 900 tests per million population.

Myanmar reported a 6% increase in new weekly deaths compared to last week. The majority of the cases and deaths continue to be reported from Yangon Region. Here, the Government has further extended stay at home orders for 44 townships from [8-21 Oct 2020]. On [3 Oct 2020], Myanmar published standard operating procedures for testing of COVID-19 with antigen-based rapid diagnostic kits and began using these in Yangon Region on [29 Sep 2020], followed by other regions and states.

Thailand continues to report relatively low numbers of cases. The country has become one of the 1st countries in the world to complete an assessment of how its health system has so far responded to COVID-19. The review highlights success factors and provides recommendations across nine areas, or "pillars" of the national response.



# COVID 19

## Western Pacific Region

Overall, one percent of all new weekly cases and deaths were reported from the Western-Pacific Region. The region reported an 8% increase in new weekly cases and a 27% decrease in new weekly deaths as compared to the previous week. The majority of new cases continue to be reported from the Philippines, Malaysia, and Japan. Whereas French Polynesia and Guam reported the highest incidence of new cases - 3713 and 3258 new cases per one million inhabitants, respectively. Papua New Guinea reported an increase of over 200% in weekly cases as compared to the previous week, with 31 new cases and 581 total confirmed cases.

Only 2 out of countries and territories in the region self-characterize their current transmission pattern as community transmission, with a further 9 (24%) countries reporting clusters of cases, and 7 (18%) countries reporting sporadic cases. The majority (n=19, 50%) of countries and territories report no active cases, and one territory is pending classification.

Malaysia reported a 51% increase in cases and deaths as compared to last week, with the majority of cases reported from Sabah State. The Ministry of Health has taken several measures to reduce transmission and increasing test capacity in the state -- daily RT-PCR tests increased from 1350 in July [2020] to 2600 as of [17 Oct 2020].

Wallis and Futuna reported its 1st positive case of COVID-19 to WHO on [19 Oct 2020]. As this falls outside of the reporting period of this update, the island territory will be reflected in next week's update.

