RAPID RISK ASSESSMENT

Novel coronavirus disease 2019 (COVID-19) pandemic: increased transmission in the EU/EEA – sixth update

12 March 2020

Summary

On 31 December 2019, a cluster of pneumonia cases of unknown aetiology was reported in Wuhan, Hubei Province, China. On 9 January 2020, China CDC reported a novel coronavirus as the causative agent of this outbreak, which is phylogenetically in the SARS-CoV clade. The disease associated with the virus is referred to as novel coronavirus disease 2019 (COVID-19).

As of 11 March 2020, 118 598 cases of COVID-19 were reported worldwide by more than 100 countries. Since late February, the majority of cases reported are from outside China, with an increasing majority of these reported from EU/EEA countries and the UK.

The Director General of the World Health Organization declared COVID-19 a global pandemic on 11 March 2020.

All EU/EEA countries and the UK are affected, reporting a total of 17 413 cases as of 11 March. Seven hundred and eleven cases reported by EU/EEA countries and the UK have died. Italy represents 58% of the cases (n=10 149) and 88% of the fatalities (n=631). The current pace of the increase in cases in the EU/EEA and the UK mirrors trends seen in China in January-early February and trends seen in Italy in mid-February.

In the current situation where COVID-19 is rapidly spreading worldwide and the number of cases in Europe is rising with increasing pace in several affected areas, there is a need for immediate targeted action. The speed with which COVID-19 can cause nationally incapacitating epidemics once transmission within the community is established, indicates that in a few weeks or even days, it is likely that similar situations to those seen in China and Italy may be seen in other EU/EEA countries or the UK.

There are no vaccines available and there is little evidence on the effectiveness of potential therapeutic agents. In addition, there is presumably no pre-existing immunity in the population against the new coronavirus and everyone in the population is assumed to be susceptible. Clinical presentations of COVID-19 range from no symptoms (asymptomatic) to severe pneumonia; severe disease can lead to death. While the majority of cases (80%) are milder respiratory infections and pneumonias, severe illness and death is more common among the elderly with other chronic underlying conditions, with these risk groups accounting for the majority of severe disease and fatalities to date.

The risk of severe disease associated with COVID-19 infection for people in the EU/EEA and UK is currently considered moderate for the general population and high for older adults and individuals with chronic underlying conditions, based on the probability of community transmission and the impact of the disease.

Suggested citation: European Centre for Disease Prevention and Control. Novel coronavirus disease 2019 (COVID-19) pandemic: increased transmission in the EU/EEA – sixth update – 12 March 2020. Stockholm: ECDC; 2020.

The risk of healthcare system capacity being exceeded in the EU/EEA and the UK in the coming weeks is considered high. The impact and risk assessment on health system capacity can be mediated by the application of effective infection prevention and control and surge capacity measures.

The risk of transmission of COVID-19 in health and social institutions with large vulnerable populations is considered high. The impact of transmission in health and social institutions can be mediated by the application of effective infection prevention and control and surge capacity.

The EU/EEA and the UK are quickly moving toward a scenario of sustained community transmission of COVID-19. The situation is evolving very quickly and a rapid, proactive and comprehensive approach is essential in order to delay transmission, as containing transmission to local epidemics is no longer considered feasible. A rapid shift from a containment to a mitigation approach is required, as the rapid increase in cases, that is anticipated in the coming days to few weeks may not provide decision makers and hospitals enough time to realise, accept and adapt their response accordingly if not implemented ahead of time. Measures taken at this stage should ultimately aim at protecting the most vulnerable population groups from severe illness and fatal outcome by reducing transmission and reinforcing healthcare systems.

Given the current epidemiology and risk assessment, and the expected developments in the next days to few weeks, the following public health measures to mitigate the impact of the pandemic are necessary in EU/EEA countries:

- Social distancing measures should be implemented early in order to mitigate the impact of the epidemic and to delay the epidemic peak. This can interrupt human-to-human transmission chains, prevent further spread, reduce the intensity of the epidemic and slow down the increase in cases, while allowing healthcare systems to prepare and cope with an increased influx of patients.
  Such measures should include:
  - the immediate isolation of symptomatic persons suspected or confirmed to be infected with COVID-19;
  - the suspension of mass gatherings, taking into consideration the size of the event, the density of participants and if the event is in a confined indoor environment;
  - social distancing measures at workplaces (for example teleworking, suspension of meetings, cancellation of non-essential travel);
  - measures in and closure of schools, taking into consideration the uncertainty in the evidence of children in transmitting the disease, need for day care for children, impact on nursing staff, potential to increase transmission to vulnerable grandparents;
  - cordon sanitaire of residential areas with high levels of community transmission.
- Ensuring the public is aware of the seriousness of COVID-19. A high degree of population understanding, solidarity and discipline is required to apply strict personal hygiene, coughing etiquette, self-monitoring and social distancing measures. Community engagement and acceptance of stringent social distancing measures put in place are key in delaying and reducing further spread.
- Prevention and control of COVID-19 in hospitals and long-term care facilities is an immediate priority in order to: (1) slow the demand for specialised healthcare, such as ICU beds; (2) safeguard populations vulnerable to severe outcomes of infection (3); protect healthcare workers that provide care; (4) minimise the export of cases to other healthcare facilities and the community.
- Every healthcare facility should initiate training for all staff and those who may be required for healthcare provision during surge capacity. Countries should identify healthcare units that can be designated to care for COVID-19 cases, to minimise transmission to non-cases and to conserve PPE. Countries and healthcare institutions should identify additional facilities that can be used for the cohorting of cases with mild symptoms, in the event that surge capacity is exceeded by healthcare facilities. The highest priority for use of respirators (FFP2/3) are healthcare workers, in particular those performing aerosol-generating procedures, including swabbing.
- If resources or capacity are limited, rational approaches should be implemented to prioritise high-yield actions, which include: rational use of confirmatory testing, reducing contact tracing to focus only on high-yield contacts, rational use of PPE and hospitalisation and implementing rational criteria for de-isolation. Testing approaches should prioritise vulnerable populations, protection of social and healthcare institutions, including staff.
- National surveillance systems should initially aim at rapidly detecting cases and assessing community transmission. As the epidemic progresses, surveillance should monitor the intensity, geographical spread and the impact of the epidemic on the population and healthcare systems and assess the effectiveness of measures in place. In circumstances with capacity shortages and strict implementation of social distancing measures, surveillance should focus on severe acute respiratory infections, sentinel surveillance in outpatient clinics or collection of data through telephone helplines.

A strategic approach based on early and rigorous application of these measures will help reduce the burden and pressure on the healthcare system, and in particular on hospitals, and will allow more time for the testing of therapeutics and vaccine development.

What is new in this update?

- Updated data on the epidemiological situation in the EU/EEA and the UK
- Recent findings on disease and transmissibility, including during the asymptomatic period
- Risk associated with COVID-19 for people from the EU/EEA and the UK
- Risk of local and widespread national community transmission in the EU/EEA and UK in the coming weeks
- Risk to healthcare systems capacity being exceeded in the EU/EEA and the UK in the coming weeks
- Risk of transmission of COVID-19 in health and social institutions with large vulnerable populations
- Options for preparedness and response focused on the mitigation phase, including rational measures in case of resource constraints or shortages
- Updated surveillance objectives and methods for the mitigation phase

Regularly updated information on severe acute respiratory syndrome coronavirus COVID-19 outbreak is available on ECDC's website [1], the European Commission website [2], and the World Health Organization's (WHO) website [3].

This risk assessment is based on published information available as of 12 March 2020.

1. Event background

For more detailed event background information, please visit ECDC's website [4].

Since ECDC's fifth update on novel coronavirus published on 2 March 2020 and as of 11 March, the number of cases and deaths reported in the EU/EEA has been rising, mirroring the trends seen in China in January-early February and in northern Italy in late February. If this trend continues, based on the quick pace of growth of the epidemic observed in China and northern Italy, it is likely that in days, or a small number of weeks, similar situations may be seen in other EU/EEA Member States.

The main developments since the 2 March 2020 risk assessment can be summarised as follows:

- All EU/EEA countries are now affected and more than 100 countries are affected worldwide.
- In the EU/EEA and the UK, 17 413 cases had been reported as of 11 March. Seven hundred and eleven cases reported by EU/EEA countries have died as of 11 March. Italy represents 58% of the cases (n=10 149) and 88% of the fatalities (n=631).
- The 14-day cumulative notification rate of COVID-19, a measure of the prevalence of active cases in the population, is 3.28 per 100 000 population in the EU/EEA as of 11 March, ranging from low rates of <0.1 to 16.3 per 100 000 in Italy and 19.8 per 100 000 in Iceland. The 14-days notification rate increased 10-fold over the last 10 days and, assuming no effect of mitigation measures, the EU/EEA and UK is predicted to reach 100 per 100 000 population (the Hubei scenario) by the end of March.
- While early in the outbreak most cases were reported in China, currently the majority of cases reported are from outside China; and since 2 March, 51% of the cases reported were from EU/EEA countries and the UK.
- There are increasing reports both globally and in the EU/EEA that local transmission has occurred extensively in multiple locations, without reported travel history to areas reporting community transmission and without epidemiological links to known cases [5-8].
- As of 11 March 2020, among the 1 597 cases reported in TESSy where the place of infection was reported, 797 (50%) were reported to be infected in the reporting country, 698 (44%) were reported to have acquired infection in another European country and 102 (6%) had acquired infection outside the EU/EEA.
- In the EU/EEA and the UK, events and locations that involve social interaction or institutional contact have been related to the development of COVID-19 clusters, including workplace interactions, religious events, festivities, health and social care settings, and travel.
- Transmission events have been reported in hospitals, with COVID-19 cases identified among healthcare workers and patients [9,10] as well as in long-term care facilities. As of 9 March, an ongoing outbreak of COVID-19 at a long-term care facility (LTCF) with 120 residents in Washington State (United States) has had 54 residents transferred to local hospitals and 26 deaths, of which 11 were within the facility. Of the 15 that died in hospital, 13 had tested positive for COVID-19. Additionally, 70 of 180 LTCF employees reported symptoms compatible with COVID-19 [11]. In a LTCF in Île-de-France region, France, as of 10 March, authorities report an outbreak of five cases among residents, including two deaths [12].
- Reports from some healthcare facilities in northern Italy indicate that intensive care capacity has been exceeded due to the high volume of patients requiring ventilation [13].
- The Director General of the World Health Organization declared COVID-19 a global pandemic on 11 March 2020.

For the most recent information on the current epidemiological situation regarding COVID-19, please visit this page [14].

2. Disease background

For information on COVID-19, please visit this page [15] on ECDC's website.

Novel coronavirus disease 2019 (COVID-19)

In December 2019, a novel coronavirus (COVID-19) was detected in three patients with pneumonia connected to the cluster of acute respiratory illness cases from Wuhan, China. By the end of February 2020, several countries were experiencing sustained local transmission, including in Europe.

Symptoms, incubation period, severity: The most commonly reported clinical symptom in laboratory-confirmed cases is fever (88%), followed by dry cough (68%), fatigue (38%), sputum production (33%), dyspnoea (19%), sore throat (14%), headache (14%) and myalgia or arthralgia (15%) [16]. Less common symptoms are diarrhoea (4%) and vomiting (5%). About 80% of reported cases in China had mild to moderate disease (including non-pneumonia and pneumonia cases), 13.8% had severe disease and 6.1% were critical (respiratory failure, septic shock, and/or multiple organ dysfunction/failure). Current estimates suggest a median incubation period from five to six days for COVID-19, with a range from one to up to 14 days. A recent modelling study confirmed that it remains prudent to consider the incubation period of at least 14 days [17,18].

Case fatality: Robust estimates for final case fatality risk for COVID-19 are still lacking and biased due to incomplete outcome data and the fact that initial detections were of mostly severe cases in most settings. Based on a large dataset from cases in China, the overall case fatality risk (CFR) among laboratory-confirmed cases was higher in the early stages of the outbreak (17.3% for cases with symptom onset from 1-10 January) and has reduced over time to 0.7% for patients with symptom onset after 1 February [16]. In data on diagnosed COVID-19 cases in China, Italy and South Korea, overall CFR was 2.3%, 2.8% and 0.5%, respectively, and increased with age in all settings, with the highest CRF among people over 80 years of age (14.8%, 8.2% and 3.7%, respectively) [19-21].

Viral shedding: Over the course of the infection, the virus has been identified in respiratory tract specimens 1-2 days before the onset of symptoms and it can persist for 7-12 days in moderate cases and up to 2 weeks in severe cases [22]. In faeces, viral RNA has been detected from day 5 after onset and up to 4 to 5 weeks in moderate cases. The virus has been detected also in whole blood [23], serum [24,25] saliva [26] and urine [27]. Prolonged viral RNA shedding has been reported from nasopharyngeal swabs, up to 37 days among adult patients [28] and in faeces, for more than one month after infection in paediatric patients [29]. It should be noted that viral RNA shedding does not directly equate with infectivity.

Basic reproduction number (R_0): The current estimates of the basic reproductive number R_0 are between 2 and 3 in settings from China [17,30,31] and during the early stage of an outbreak on a cruise ship [32].

Infection in asymptomatic individuals: The virus has been detected in asymptomatic persons. On a rapidly evolving cruise ship outbreak, where most of the passengers and staff were tested irrespective of symptoms, 51% of the laboratory confirmed cases were asymptomatic at the time of confirmation [33]. In Italy, 44% of the laboratory-confirmed cases have been asymptomatic [34]. In Japan, 0.06% of reported cases have been asymptomatic [35]. These proportions based on nationally notified cases likely reflect laboratory testing algorithms rather than true estimates of asymptomatic infections.

Based on Chinese data, the international WHO mission report indicates that up to 75% of initially asymptomatic cases will progress to clinical disease, making the true asymptomatic infection rather rare (estimated at 1-3%) [16].

Both viral RNA and infectious virus particles were detected in throat swabs from two German citizens evacuated from Hubei province on 1 February 2020, who remained well and afebrile seven days after admission to a hospital in Frankfurt [36]. Both a mother and a child in a family cluster remained asymptomatic (including normal chest CT images during the observation period) with qRT-PCR positive nasopharyngeal swab samples [37]. Similar viral load in asymptomatic versus symptomatic cases was reported in a study including 18 patients [38]. Persistent positivity of viral RNA in throat and anal swabs were reported in a asymptomatic female patient after 17 days of clinical observation and treatment [39].

Potential transmission from an asymptomatic person has been reported in a familial cluster of five COVID-19 patients hospitalised with fever and respiratory symptoms that had contact before their onset of symptoms with an asymptomatic family member, a young 20-year-old woman, upon her return from Wuhan [40]. She remained asymptomatic for the whole duration of laboratory and clinical monitoring (19 days).

Transmission in pre-symptomatic stage of infection: In addition to case reports, pre-symptomatic transmission has been inferred through modelling, and the proportion of pre-symptomatic transmission was estimated to be around 48% and 62% [41]. Pre-symptomatic transmission was deemed likely based on a shorter serial interval of COVID-19 (4.0 to 4.6 days) than the mean incubation period (five days) with the authors indicating that many secondary transmissions would have already occurred at the time when symptomatic cases are detected and isolated [42]. Major uncertainties remain in assessing the influence of pre-symptomatic transmission on the overall transmission dynamics of the pandemic.

Vulnerable groups: Population groups that have been more frequently reported having severe disease and death include people above 60 years of age, males, people with underlying conditions such as hypertension, diabetes, cardiovascular disease, chronic respiratory disease and cancer [16,25,28,43,44]. The proportion of most of the reported chronic diseases

and health conditions is similar to the prevalence of these conditions in the elderly age groups in China, therefore they might be surrogates of increasing age only. Higher ACE (angiotensin converting enzyme II) gene expression may be linked to higher susceptibility to SARS-CoV-2. It has been shown that ACE 2 expression in lung tissues increases with age, tobacco-use and with some hypertensive treatment. These observations might explain the vulnerability of older people, tobacco-users/smokers and those with hypertension; they also highlight the importance of identifying smokers as a potential vulnerable group for COVID-19 [45-48].

There is limited scientific evidence on the severity of illness among pregnant women with COVID-19. Pregnant women appear to experience similar clinical manifestations as non-pregnant adult patients with COVID-19 pneumonia. There is no evidence of severe adverse outcomes in neonates due to maternal COVID-19 pneumonia, and the virus has not been found in breastmilk [49,50].

Currently available information indicates that children are as likely to be infected as adults, however they experience mild clinical manifestations [34,51]. About 2.4% of the total reported cases in China (as of 20 February 2020) were individuals under 19 years of age. A very small proportion of those aged under 19 years have developed severe (2.5%) or critical disease (0.2%) [16].

Estimates of all of the above parameters are likely to be revised and refined as more information becomes available.

There is currently no specific treatment or vaccine against COVID-19 infection, however several clinical trials are recruiting globally to assess the effect of different treatment options and some information in clinical case management is provided under 'Options for response'.

Modelling scenarios related to epidemic peak and health care capacity saturation

ECDC estimated the risk of saturation of intensive care unit (ICU) beds and non-ICU beds, as well as hospital isolation capacity (airborne infection isolation rooms and single-bed rooms), through a simulation approach using hospital data of the 2016-2017 ECDC point-prevalence survey of healthcare-associated infections in acute care hospitals [52]. Hospital capacity was evaluated as a function of increasing prevalence of hospitalised COVID-19 cases per 100 000 population, for three levels of hospitalised COVID-19 patients requiring ICU care (5%, 18% and 30% severity scenarios), and using bed occupancy rates measured outside the winter season. The 14-days cumulative notification per 100 000 population was used as a proxy of the prevalence of active COVID-19 cases.

Based on these estimates four EU/EEA countries [0 - 10, depending on severity] would have a high risk of seeing their ICU capability saturated at a prevalence of 10 hospitalised COVID-19 cases per 100 000 population (approximately twice the Mainland China prevalence scenario at the peak of the epidemic). At a prevalence of 18 hospitalised cases per 100 000 (the Lombardy scenario as of 5 March) 12 countries [0 – 21, depending on severity] have a high risk of ICU capability becoming saturated. The ICU capacity of all [7 - 28] countries would be exceeded at a prevalence of 100 hospitalised per 100 000 (the Hubei province scenario at the peak of the epidemic) (Annex 2). Nonetheless, despite ICU capacity saturation in most countries, more than half of the countries (17) would still have a residual non-ICU bed capacity in the Hubei scenario.

The airborne infection isolation room capacity would be saturated in all countries, well before reaching a prevalence of 10 hospitalised cases per 100 000. In the same prevalence scenario, six countries would not have residual isolation capacity in single rooms either, and no country would have any single room capacity left in a Hubei province scenario. It is important to emphasise that the time needed to reach a saturation situation depends on the size of the country, but that at regional and sub-regional level, hospital systems may be overwhelmed much earlier.

According to predictions of the 14-day cumulative notification rate, the majority of EU/EEA countries would reach the Hubei scenario by end of March and all countries by mid-April 2020. These predictions need to be interpreted with caution because of prediction intervals inherent to modelling, and because of the underlying assumptions of: 1) a stable diagnostic testing policy and capacity and 2) an absence of effective mitigation measures.

3. ECDC risk assessment

Many unknowns remain regarding the virulence/pathogenicity, the effectiveness of different modes of transmission, the proportion of mild and asymptomatic cases, the infectivity during the incubation period and during recovery, the impact of individual or population-based preventive measures, the risk factors for severe illness besides age, and the effectiveness of treatment regimes. So far, detailed epidemiological data available are still limited.

This assessment is based on facts known to ECDC at the time of publication, and unless otherwise stated, the assessment of risk refers to the risk that exists at the time of writing this report. It follows the ECDC rapid risk assessment methodology with relevant adaptations [53].

Risk assessment questions

- What is the overall risk, as of 11 March 2020, associated with COVID-19 for the EU/EEA and UK?
- What is the risk of sub-national community transmission occurring in countries in the EU/EEA and the UK in the coming weeks?
- What is the probability of widespread national community transmission in the EU/EEA and the UK in the coming weeks?
- What is the risk of healthcare system capacity being exceeded in the EU/EEA and the UK in the coming weeks?
- What is the risk associated with transmission of COVID-19 in health and social care institutions with large vulnerable populations?

What is the overall risk, as of 12 March 2020, associated with COVID-19 infection for the EU/EEA and UK?

The risk of severe disease associated with COVID-19 infection for people in the EU/EEA and UK is currently considered moderate for the general population and high for older adults and individuals with chronic underlying conditions. In addition, the risk of milder disease, and the consequent impact on social and work-related activity, is considered high.

This assessment is based on the following factors:

- There are an increasing number of cases in several EU/EEA countries without epidemiological links to explain the source of transmission. In some countries, transmission within healthcare settings has been reported affecting healthcare workers. As reported cases increase globally in a growing number of countries (found here), the likelihood of continued introductions into and between EU/EEA countries will increase. Given these factors, the probability of further transmission in the EU/EEA and the UK is considered very high. The speed with which COVID-19 can cause nationally incapacitating epidemics once transmission within the community is established indicates that it is likely that in a few weeks or even days, similar situations to those seen in China and Italy may be seen in other EU/EEA countries or the UK, as more countries report evidence of community transmission.
- The evidence from analyses of cases to date is that COVID-19 infection causes mild disease (i.e. non-pneumonia or mild pneumonia) in about 80% of cases and most cases recover, 14% develop more severe disease and 6% experience critical illness. Severe illness and death is more common among the elderly and those with other chronic underlying conditions, with these risk groups accounting for the majority of severe disease and fatalities to date. In the event of a disruption of healthcare services, the impact could be very high. In addition to the public health impact with substantial fatal outcomes in high-risk groups, COVID-19 outbreaks can cause huge economic and societal disruptions.

What is the risk of occurrence of subnational community transmission of COVID-19 in the EU/EEA and the UK in the coming weeks?

The risk of the occurrence of subnational community transmission of COVID-19 in the EU/EEA and the UK is currently considered very high.

This assessment is based on the following factors:

- Several events already reported in Europe indicate that local transmission may have resulted in several sub-national clusters. The accumulated evidence from clusters reported in the EU/EEA and the UK indicates that once imported, the virus causing COVID-19 can be transmitted rapidly. It is plausible that a proportion of transmissions occur from cases with mild symptoms that do not provoke healthcare-seeking behaviour. The increase in case numbers and the number of countries reporting those cases globally increases the potential routes of importation of the infection into and between countries in the EU/EEA and the UK. The likelihood of this occurring depends on the speed of detection of local transmission and whether effective response measures are applied early enough at-scale. Early evidence from several settings globally indicates that rigorous public health measures, particularly related to isolation and social distancing, implemented immediately after identifying cases can reduce but does not exclude the probability of further spread.

- The impact of such clusters in local areas would be high, but would depend on national capacity to organise surge capacity across regions. The impact would be especially high if hospitals are affected and a large number of healthcare workers need to be isolated or become infected. The impact on vulnerable groups in the affected hospitals or healthcare facilities would be severe, in particular for the elderly.

What is the risk of occurrence of widespread national community transmission of COVID-19 in the EU/EEA and UK in the coming weeks?

The risk of occurrence of widespread national community transmission of COVID-19 in the EU/EEA and the UK in the coming weeks is high.

This assessment is based on the following factors:

- There is an increasing number of countries with local community transmission around the world and in Europe, and a growing number of areas reporting local sub-national community transmission. Exportations have caused transmission in previously unaffected areas. The control measures have, up to now, only been able to slow the further spread, but not to stop it. If numerous local sub-national clusters of community transmission arise simultaneously, they could merge into a situation of widespread national community transmission. The likelihood of this occurring depends on the speed of detection of local transmission and whether effective response measures are applied early enough and at-scale. Early evidence from several settings globally indicates that rigorous public health measures, particularly related to isolation and social distancing, implemented immediately after identifying cases can reduce but does not exclude the probability of further spread. Evidence to-date from China, and emerging evidence from Korea, indicates that early decisive actions may reduce community transmission.
- The impact of national community transmission would be high, especially if hospitals are affected and a large number of healthcare workers need to be isolated or become infected. The impact on vulnerable groups in the affected hospitals or healthcare facilities would be severe, in particular for the elderly.

What is the risk of healthcare system capacity being exceeded in the EU/EEA and the UK in the coming weeks?

The risk of healthcare system capacity being exceeded in the EU/EEA and the UK in the coming weeks is considered high.

This assessment is based on the following factors:

- As the number of reported COVID-19 cases in the EU/EEA and the UK has increased in the last 10 days, very quickly in several EU/EEA countries, the probability of increased clusters in local areas and increased widespread community transmission is considered high. Analyses carried out by ECDC indicate that if the pandemic progresses on its current course without strong countermeasures or surge capacity enacted, that most EU/EEA countries will far exceed the available ICU capacity they currently have available by the end of March.
- Influenza season is still ongoing, creating a heavy burden on ICUs, however, EU/EEA countries might have already moved past the peak period of high influenza circulation and countries reporting hospital data saw a declining number of hospitalisations due to influenza over the last few weeks. This allows for some optimism regarding the availability of ICU beds, although the mean duration of ICU hospitalisation for influenza is around 10 days. For the latest influenza update see the joint ECDC–WHO/Europe weekly influenza update [54].
- The continued pattern of increase in COVID-19 cases is very similar to that of Hubei province in mid- and late-January 2020. If the increase continues, in the absence of the application of mitigation measures, the potential impact on the public health and overall healthcare systems would be high. Increasing numbers of imported cases from other EU countries and local transmission chains require substantially more resources, i.e. staff for case management, surveillance, and contact tracing, which in some countries is beginning to or already has overstretched public healthcare systems. Risk communication to concerned members of the public and healthcare professionals continues to demand significant and growing staff resources. As testing needs for COVID-19 increase, some laboratories are reporting crucial shortages affecting diagnostic capacity for COVID-19 and other laboratory services. Further increased transmission could result in a significant increase of hospital admissions at a time when healthcare systems may already be under pressure from the current influenza season. Several parts of Italy have already reported healthcare system saturation due to very high patient loads requiring intensive care. Already stretched capacity would be further exacerbated if substantial numbers of healthcare workers became infected with COVID-19. The impact of increased pressure on the health system introduced by COVID-19 is dependent on the level of preparedness and surge capacity that a given country or area has enacted or can quickly enact.
- While it is likely not feasible to stop the spread of COVID-19 in the EU/EEA, it is essential to introduce measures to slow down the spread of the virus in the population in order to allow healthcare systems to put in place surge capacity measures to absorb more severe COVID-19 cases. These options are listed under 'Options for response' and recent ECDC guidance documents [55]. The implementation of these mitigation measures will determine the eventual level of impact of the epidemic on health system capacity.

What is the risk associated with transmission of COVID-19 in health and social care institutions with large vulnerable populations?

The risk associated with transmission of COVID-19 in health and social institutions with large vulnerable populations is considered high.

This assessment is based on the following factors:

- The number of reported COVID-19 cases in the EU/EEA and the UK has increased in the last 10 days, very quickly in several EU/EEA countries, and the probability of increased clusters in local areas is considered high. In some settings, transmission within healthcare settings, including long-term care facilities has been reported. It is plausible that a proportion of transmissions occur from cases with mild symptoms that do not provoke healthcare-seeking behaviour, however these cases can still transmit the virus. If health and social institutions are exposed to the virus by health workers or family members with mild infection, the virus could spread quickly in such a setting, in the absence of very early detection and highly effective infection control. The probability of transmission in such settings can be modified by the level of implementation of robust IPC measures and early detection and isolation of introduced cases in patients, residents or staff.
- The great majority of the most severe illnesses and deaths have occurred among the elderly and those with other chronic underlying conditions. Thus, the impact on vulnerable groups in affected hospitals or healthcare facilities would be severe, in particular for the elderly. The impact would be especially high if a large number of healthcare or social care workers need to be isolated or become infected.

4. Preparedness and public health response

Five scenarios describing the possible progression of the COVID-19 outbreak in EU/EEA countries were presented in ECDCs fifth Rapid Risk Assessment on COVID-19 (Annex 1) [56].

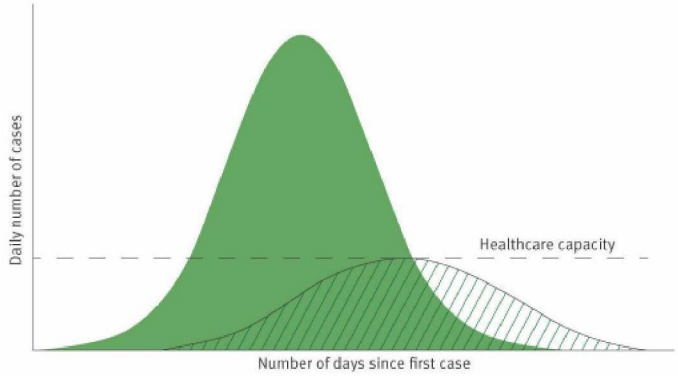
Currently, EU/EEA countries' epidemiological situation varies by region, but analysis of the epidemic progression indicates that the situation in Italy and other EU/EEA countries are generally following the epidemic curve that was noted in China during January and February and by South Korea in recent weeks. While most countries in the EU/EEA and the UK are currently in scenario 2, all available data indicates that they are very rapidly moving toward a scenario of sustained community transmission of COVID-19 (scenario 3). The situation is evolving quickly, and the currently notified cases reflect a situation in terms of transmission pressures about a week ago. Therefore, a proactive and aggressive approach is needed to delay transmission, as containing transmission in a specific area or country in the EU/EEA is no longer considered feasible (Figure 1). A rapid shift from a containment to a mitigation approach is required as the rapid increase in cases anticipated in the coming days to few weeks may not provide decision makers and hospitals enough time to realise, accept and adapt their response accordingly if not implemented ahead of time.

All EU/EEA countries should immediately and proactively initiate appropriate, proportional and evidence-based response options to prevent a situation of evolution to scenario 4, where the intensive care capacity is saturated and health systems are overwhelmed. The options provided below, therefore, focus on scenarios 2-4, which describe local and nationwide transmission scenarios. Options for scenarios 0 and 1 can be found in ECDC's previous risk assessment [56]

In the current phase of the pandemic in the EU/EEA, priority response measures should focus on high-risk groups, healthcare systems and healthcare workers in order to ensure rapid detection and diagnosis of cases and protect healthcare staff, patients and other contacts from exposure. Measures to ensure appropriate functioning of the healthcare system (including laboratories) with increasing numbers of cases should be implemented. Social distancing measures and risk communication remain essential pillars to effective mitigation approaches, while rational testing, contact tracing and surveillance approaches can be implemented to match resource availability and capacity.

The options proposed for preparedness and response aim to limit the impact of the pandemic on healthcare systems and vulnerable population groups by delaying the epidemic peak and decreasing the magnitude of the peak.

Figure 1. Illustration of the objectives of community mitigation measures in a scenario of widespread community transmission of COVD-19



Activation of pandemic preparedness plans

All EU/EEA Member States should have activated their pandemic preparedness plans in the context of COVID-19. In scenarios 3 and 4, it is crucial that all critical elements of pandemic preparedness plans are up to date and response strategies are already being implemented in a coordinated fashion across government departments and sectors of society. Focused attention should be given to the areas of command, control and intersectoral coordination, coordinated risk communication, hospital preparedness, and business continuity planning for the healthcare sector and critical societal services.

The infrastructure for rapid intersectoral information exchange and decision-making should be effective to enable communication and coordination of response strategies between the national crisis team and relevant stakeholders and sectors from the regional to the national levels. To operationalise the response system, it is important to establish both the legal framework and develop standardised procedures that enable its implementation. Therefore, the roles and responsibilities of all relevant stakeholders involved in the risk management within or outside the national crisis team and the lines of communication should be defined. The overall crisis management scheme should be informed by public health risk assessments and by monitoring of key indicators of response. For the public health sector these include: surveillance, laboratory diagnostics, case investigation and contact tracing; for the healthcare system: isolation capacity, occupancy rates for regular and ICU beds, PPE availability, availability of essential drugs, equipment for mechanical ventilation and oxygenation and other hospital supplies.

Hospital preparedness and activation of contingency plans is an absolute priority at this moment. In healthcare settings, surge capacity plans should be developed and/or revised to address the expected high demand for care of increased numbers of patients with moderate or severe respiratory distress. Accumulating anecdotal evidence from north Italy points to significant pressure experienced in emergency departments and critical care services, specifically in the availability of ventilator equipment and PPE. Evidence from China, South Korea and Italy points at the need to:

1) design and implement an overall strategy of discouraging symptomatic patients from presenting to any facility without prior instructions

2) designate treatment facilities both for mild and for severe COVID-19 cases with critical care capabilities (e.g. ECMO). This implies activation of hospital plans to the highest level to be able to cancel elective diagnostic and operative procedures and re-assign human resources, creating temporary treatment facilities for the mild cases or advising self-isolation until symptoms improve or worsen [57,58].

3) Ban access to hospitals to family and friends of admitted patients. In addition, decreasing the administrative workload for healthcare workers e.g. providing sick leave certificates electronically or by phone, would free up resources. Finally, it is crucial to prepare or adapt business continuity plans for healthcare facilities in accordance with the latest public health risk assessment and guidance from national, regional or local health authorities to ensure continuity of essential health services. For more details, please consider the related hospital preparedness checklist [59].

It is important that planned response strategies, including diagnostic testing, can be adapted according to case finding strategies and adjusted to a surge of cases by de-escalating procedures that might no longer be feasible and/or beneficial [60].

It is crucial to also prepare or adapt business continuity plans for non-healthcare settings in accordance with the latest public health risk assessment and guidance from national, regional or local health authorities to ensure continuity of essential services (e.g. transportation, energy, and information technology sectors). Overall, the business continuity plans should define the procedures and processes a business or organisation or healthcare facility should follow in response to the potential impact of COVID-19 on critical functions (processes, assets and human resources). The plan should also include policies and recommendations for employees with symptoms of acute respiratory illness, routine environmental cleaning and travel health advice [61] based on the objectives of the business continuity plan. Collaboration with supply chain partners and other stakeholders has to be initiated to understand the usage, availability and access to critical resources, and sustainable financing mechanisms could be put in place.

Risk communication

A high level of public awareness is a prerequisite for an effective response with social distancing measures to the COVID-19 outbreak. Risk communication activities should emphasise that although this is a new and highly contagious disease, the vast majority of infected people will recover. Easily accessible information should be available on the signs and symptoms (i.e. fever and dry cough) of COVID-19; the contact details of local health services and national hotlines; the population groups at high risk of severe disease; social distancing measures that may be in place; and travel advice. All relevant audiences should be targeted, including through the use of appropriate minority languages. Monitoring systems should be put in place to observe public perceptions, opinions and compliance with individual measures. Procedures for identifying and rapidly addressing misinformation, disinformation and rumours, especially on social media platforms, should be established.

The public need for accurate, evidence-based information and advice on COVID-19 are very high, and extraordinary efforts for rapid and continuous information provision to the general public and healthcare staff should be ongoing. Information should be communicated in a transparent and consistent way to stakeholders and to the public, according to the unfolding epidemiological situation. Risk communication strategies should clearly provide the rationale behind any non-pharmaceutical countermeasures that are implemented or planned, such as social distancing.

The need for individual and shared responsibility should be emphasised through a focus on frequent hand washing, always covering the mouth and nose with tissues or elbow when sneezing or coughing, and implementation of self-isolation when symptomatic. Messaging on self-isolation and voluntary quarantines should encourage consideration of a support system to provide essential services and supplies (e.g. food and medication). Vulnerable individuals including the elderly, those with underlying health conditions, disabled people, people with mental health problems, homeless people, and undocumented migrants will require extra support and perhaps specific communication channels and language. Authorities may want to consider coordinating with and supporting civil society and religious groups who already work with these populations. Please refer to the guidance on community engagement for more details.

Infection prevention and control in healthcare settings

An important proportion of reported cases in China and Italy, especially from the initial period of the outbreaks have been among healthcare workers. Such cases have important consequences in addition to the health of the individuals, as quarantine measures may need to be put in place for close contacts among staff, and the exposure may be life threatening for exposed patients in the healthcare facilities. Therefore infection prevention and control (IPC) practices are of critical importance in controlling the COVID-19 pandemic protecting the functioning of healthcare services and mitigating the impact on vulnerable populations.

ECDC has published an update of its technical report on infection prevention and control (IPC) for the care of patients with COVID-19 in healthcare settings [60]. The update, for administrators and healthcare professionals, outlines technical measures and resources for reducing the risk of transmission of COVID-19 in healthcare settings, including LTCF, and laboratories in the EU/EEA. Guidance is provided for preparedness; triage, initial contact and assessment in primary and emergency care; patient transport; environmental cleaning; and waste management.

The immediate priority is to designate a full-time staff member at each health facility to be the lead for infection prevention and control and preparedness for COVID-19, responsible for the education and training of staff, including full compliance with hand hygiene according to WHO's 5 Moments for Hand Hygiene approach before touching a patient [62]. Training on standard IPC precautions for all staff should be initiated. If feasible, provide training to those who may be required for healthcare provision during surge capacity, for example agency staff, student doctors/nurses and retired health professionals.

Respiratory hygiene measures include ensuring that all staff and patients cover their nose and mouth with a tissue or elbow when coughing or sneezing; offering a medical mask to those with suspected 2019-nCoV infection while they are in waiting/public areas or in cohorting rooms; and performing hand hygiene after contact with respiratory secretions. Staff with symptoms compatible with COVID-19 should contact a pre-identified 24/7 contact line at the facility and self-isolate. If a suspected or confirmed case of COVID-19 is detected in a facility, all staff should be informed [60]. If cases are cared for in the home environment, IPC measures are outlined in the WHO guidance for homecare of patients with COVID-19 [63].

LTCFs should implement the baseline options for preparedness for COVID-19 described in the guidance document, given that the rapidity of an onset of a COVID-19 outbreak may result in insufficient time to implement the necessary IPC [60].

Countries and healthcare institutions should identify additional facilities (e.g. healthcare units, departments, or existing healthcare buildings) that can be used for the cohorting of cases with mild symptoms, in advance of capacity being exceeded in existing healthcare facilities. Cohorting may help conserve PPE and reduce the risk of transmission to non-cases. The minimum requirements for units designated for the management of confirmed COVID-19 patients are the availability of isolation rooms with a dedicated bathroom, staff adequately trained in the safe diagnostic evaluation and management of COVID-19 patients; the availability of appropriate PPEs; adequate laboratory support; and appropriate cleaning and waste management procedures. Negative pressure isolation rooms are strongly recommended for the performance of aerosol generating procedures [60].

ECDC published a technical report on personal protective equipment needs in healthcare settings for the care of patients with suspected or confirmed COVID-19 [57,64]. When using PPE, the correct donning and doffing process should be followed; further information on these procedures can be found in the ECDC Technical Document 'Guidance for wearing and removing personal protective equipment in healthcare settings for the care of patients with suspected or confirmed COVID-19' [65]. [66]

Rational use of PPE and hand hygiene materials for the care and management of COVID-19

As of March 2020, countries worldwide that are facing COVID-19 are experiencing reduced access to PPE and hand hygiene materials [67]. An immediate priority has been set at EU level to ensure adequate production and supply of PPE for healthcare workers and patients, and a joint procurement process has been launched by the European Commission for interested EU Member States. Coordinated supply chains for PPE should ensure distribution of such materials to healthcare systems to reduce the potential for healthcare-associated transmission to vulnerable groups and to healthcare-workers [66] Cross-border supply and donations to highly affected areas should continue in order to decrease overall infection pressures in EU/EEA countries.

The ECDC guidance document 'Infection prevention and control for the care of patients with novel coronavirus in healthcare settings – 1st Update' [60] highlights both best practice for PPE and also highlights options for hospitals and LTCFs that have limited access to such materials. The main priorities in this document for rational use are in concordance with detailed guidance published by WHO in February 2020 [68]. A nasopharyngeal swab is an aerosol-generating procedure (AGP), because, for example, it can induce coughing [69].

In order to maximize the use of available PPE in the event of insufficient stocks, staff should be allocated to perform a procedure, or set of procedures in designated areas. For example, designate staff for swabbing procedures in a dedicated swabbing area.

Priorities for use of respirators (FFP2/3)

- The highest priority is for healthcare workers, most particularly those performing AGP, including tracheal intubation, bronchial suctioning, bronchoscopy, and sputum induction. ECDC emphasises that taking a nasopharyngeal swab as part of a test for COVID-19 is an AGP;
- Respirators can be used for up to 4 hours for multiple patients without removing them [68], unless the respirator is damaged, soiled or contaminated, for example a symptomatic suspected case coughing on them.;
- In the absence of FFP2/3 respirators, healthcare workers should use masks with the highest available filter level;
- If there is an insufficient stock of respirators, then staff engaged in environmental cleaning and waste management should wear a surgical mask, in addition to gloves, goggles and gown [66].

Priorities for use of surgical masks

- The highest priority are for symptomatic confirmed cases of COVID-19, followed by suspected cases;
- The next highest priority is for those caring for COVID-19 patients, if no respirators are available.

Priorities for use of alcohol-based hand rub

- Prioritise rigorous hand-washing practices using water and soap, ensuring access to hand-washing facilities;
- If alcohol-based hand rub is not available, the highest priority is at the point-of-care, prioritising confirmed cases. If sufficient stocks are available, place in common areas with high footfall outside of designated COVID-19 areas.

Priorities for use of other PPE and hand hygiene products

- If insufficient quantities of gowns are available, use aprons;
- If insufficient quantities of goggles and/or visors are available for the recommended uses described below, use products that can be decontaminated, if available. Otherwise, consider decontamination and reuse, consulting the guidelines of the manufacturer;
- Regular cleaning followed by disinfection is recommended, using hospital disinfectants active against viruses, for rooms accessed by patients/residents, furniture and frequently touched surfaces. In the event of shortages of hospital disinfectants, decontamination may be performed using 0.1% sodium hypochlorite (dilution 1:50 if household bleach at an initial concentration of 5% is used) after cleaning with a neutral detergent, although no data are available for the effectiveness of this approach against COVID-19 [70]. Surfaces that may become damaged by sodium hypochlorite may be cleaned with a neutral detergent followed by a 70% concentration of ethanol;

- In LTCFs with insufficient quantities of paper towels, use clean cloth towels and replace them regularly, washing them with a detergent such as household washing powder [71].

Clinical case management of COVID-19 cases

Clinical presentation among reported cases of COVID-19 varies in severity from asymptomatic and subclinical infection or mild illness to severe or fatal illness. Some reports suggest there is the potential for clinical deterioration during the second week of illness. Chinese data suggest a severity profile of about 80% mild cases (including subclinical), 13-15% moderate to severe cases requiring oxygen supplementation and hospitalisation and up to 5% critically ill, requiring ICU support [16,25,72,73]. For a description of vulnerable groups please see section above "Disease background".

Patients with a mild clinical presentation (mainly with fever, cough, headache and malaise) may not initially require hospitalisation and can be safely managed at home. However, as clinical signs and symptoms may worsen with progressive dyspnoea due to lower respiratory tract disease in the second week of illness; all patients should be monitored closely. An estimated 10-15% of mild cases will progress to severe and 15-20% of severe cases will become critical according to the Chinese data [16].

Average progression times include the following:

- For mild cases: from onset of symptoms to recovery almost 2 weeks
- For severe cases: from onset of symptoms to recovery 3-6 weeks, and from onset of symptoms to death 2-8 weeks.

Designated facilities for caring for COVID-19 patients with mild symptoms should be considered in scenarios 3 and 4 in order to cohort confirmed cases and limit further transmission in the household. However, in scenario 3, and especially in scenario 4, home health care can be considered for those presenting with mild symptoms, unless there is concern for rapid deterioration. Home health care could also be considered for symptomatic patients no longer requiring hospitalisation, where inpatient care is unavailable or unsafe (i.e. limited capacity and resources unable to meet demand for healthcare services) or in a case of informed refusal of hospitalisation [63]. Rigorous education for cases and their household members is needed for appropriate IPC practices to limit secondary transmission.

Criteria to be considered when deciding whether a confirmed COVID-19 case can be safely discharged (i.e. without being infectious) from hospital have been proposed by ECDC [74]. Clinical criteria such as resolution of symptoms or absence of fever and laboratory evidence of SARS-CoV-2 clearance from upper respiratory tract should be considered but also adapted to the local context i.e. existing capacity of the healthcare system, laboratory diagnosis resources and the current epidemiology situation. After discharge, 14 days of further isolation at home or in other community care settings is advised, provided that regular health monitoring is ensured (e.g. follow-up visits, phone calls) and conditions to protect family members and the community from infection and further spread of SARS-CoV-2 exist.

Patients with severe illness should be cared for in a designated treatment hospital and should be placed in an airborne infection isolation room if available, or in a single room with private bathroom. Guidance for clinical care of severe cases is available from WHO [75] and from the US CDC [76]. In scenarios 3 and 4, solutions to increase hospital surge capacity can be explored as discussed above in the options for preparedness.

No antiviral or other pharmaceutical is currently recommended for the treatment of COVID-19 cases, although clinical trials with the combination lopinavir/ritonavir and the orphan drug redemsivir are ongoing in Asian countries and the USA. Compassionate use of remdesivir has been used for severe cases in EU countries. The evidence for the potential effectiveness of chloroquine is from *in vitro* trials and unpublished single arm studies in China at this point. Inhalational interferon beta 1a is also among potentially interesting candidates for treatment or prophylaxis [77]. Recruiting patients in Europe into multinational clinical trials to ensure rapid data collection and assessment of the safety and effectiveness of treatment options is an immediate priority in countries in the early phases of the outbreak.

Health authorities are encouraged to monitor the treatment modalities used in their countries, and physicians treating COVID-19 cases are also invited to join WHO's clinical network where new therapeutic options and experiences are exchanged.

Community measures

ECDC guidelines for the use of non-pharmaceutical countermeasures to delay and mitigate the impact of the COVID-19 pandemic include a description of the measures that can be applied in the community: infection prevention and control, social distancing, travel-related and screenings of travellers [55].

Infection prevention and control in the community

The use of personal protective measures (i.e. rigorous hand hygiene, cough etiquette, and face masks) may contribute to reducing the risk of transmitting or acquiring COVID-19 infections.

- Rigorous hand-washing schemes, including washing of hands with soap and water for at least 20 seconds, or cleaning hands with alcohol-based solutions, gels or tissues is recommended in all community settings in all possible scenarios. Organisations should ensure availability of sufficiently and suitably located washbasins and taps, as well as hand gels, to encourage washing. Proper hand hygiene will also reduce the transmission of other communicable diseases.

- Covering the mouth and nose when coughing and sneezing (e.g. by using a paper tissue, and sneezing or coughing into the elbow) may mechanically block the droplet transmission that is believed to be the principal transmission mode for COVID-19. The proper disposal of used tissues is important, followed by immediate hand washing after coughing/sneezing.
- The use of surgical face masks decreases the risk of infecting others when worn by a person with respiratory symptoms before seeking medical advice and while being assessed. There is no evidence on the usefulness of face masks worn by persons who are not ill, therefore this is not advisable [55]. It is possible that the use of facemasks by untrained people may even increase the risk of infection due to a false sense of security and increased contact between hands, mouth and eyes. In view of scenario 4, reserving PPE for use by healthcare workers should be a priority.

All people with progressing acute respiratory infections (with or without travel history) should be advised to seek medical attention, first by phone, in case symptoms worsen. Risk groups should be told to seek medical advice early, given the possibility of more rapid progression to severe disease.

Social distancing measures

Appropriate social distancing measures have to be strictly implemented. In the current phase of the pandemic in the EU/EEA, self-isolation of symptomatic persons and monitoring of symptoms of healthy contacts will reduce local transmission. Although there is some evidence that the infectious period may begin just before symptom onset, most of the infectiousness likely coincides with the symptomatic period, even when symptoms are mild and very non-specific. The infectious period is now estimated to last for 7-12 days in moderate cases and up to 2 weeks in severe cases [22].

Individual social distancing measures (e.g. avoiding shaking hands and kissing, and avoiding crowded transports and non-essential meetings and mass gatherings) should be recommended at organisational, national and EU levels as a preventive measure.

Additional steps include school and day care measures or closures, measures at the workplace, and measures related to mass gatherings. In some countries such as China, and more recently in Italy, internal travel restrictions or "Cordon sanitaire" have been imposed on large populations together with other containment measures.

The evidence for the effectiveness of closing schools and workplaces, and cancelling mass gatherings is limited. However, one modelling study from China estimated that if a range of non-pharmaceutical interventions, including social distancing, had been conducted one week, two weeks, or three weeks earlier in the country, the number of COVID-19 cases could have been reduced by 66%, 86%, and 95%, respectively, together with significantly reducing the number of affected areas [72].

School and day care measures or closure

Before or instead of closures, health authorities should plan to reduce transmission opportunities within schools while children continue to attend through other measures. These may include smaller school groups, increasing physical distance between children in the class, promotion of washing of hands and outdoor classes. In the event of illness, strict isolation of sick children and staff at home or healthcare facilities is advisable in all the scenarios.

The impact of generalised school closure in limiting the progression of the COVID-19 pandemic is uncertain. Evidence originating from seasonal and pandemic influenza modelling studies have shown that proactive school closures before the peak of influenza virus activity have had a positive impact in reducing local transmission and delaying the peak of the influenza activity [73]. While COVID-19 causes disease in children, it is mostly mild, and it is not known whether or the extent to which asymptomatic or mildly symptomatic children play an important role in transmission of the virus. Therefore, proactive school closures should be carefully considered in the context of a series of other prevention and mitigation layers to reduce the transmission of COVID-19 weighing the expected impact of the epidemic against the adverse effects of such closures on the community. School closures may have an impact on availability of healthcare staff, due to the need to caring for their children when not in school. Also, if grandparents are asked to care for the children, the benefits of lower transmission between children might be offset by transmission into a more vulnerable population group. In order for school closures to be effective, mixing of school-aged children in other settings outside of schools should be avoided.

Proactive school closures may be considered as a means of reducing the burden of influenza cases on healthcare systems, especially if influenza is circulating in the community. This could thereby create capacity for managing cases of COVID-19 in scenarios 2 and 3. Reactive closures of schools may be necessary as a consequence of widespread virus transmission in the community and educational settings in scenario 4. Such reactive school and day-care closures will probably not reduce the impact of the epidemic, but may be needed due to high absenteeism and operational issues.

Measures at the workplace

Workplace measures refer to a variety of actions to reduce the risk of transmission by decreasing contact opportunities in the workplace and the community. These measures could include for example: flexible working schedules/shifts for employees, the opportunity of distance working/teleworking, encouraging physical distancing measures within the workspace, increased use of email and teleconferences to reduce close contacts, reduced contact between employees and customers, reduced contact between employees, adoption of flexible leave policies and promoting the use of other personal protective and environmental countermeasures [78].

COVID-19 can be transmitted from person-to-person at workplaces and in other public settings where people gather in contained spaces for long periods. Viral transmission may therefore be reduced by decreasing the frequency and length of social interactions and physical contacts. Employers should encourage and support self-isolation of employees at home in case they experience respiratory symptoms; efforts should be made to identify symptomatic persons in the workplace for this purpose.

Measures related to mass gatherings

Mass gatherings, such as sport events, concerts, religious events and conferences increase the number of close contacts between people for long periods, sometimes in confined spaces, and may be attended by individuals who have travelled from widespread areas with differing levels of community transmission of the virus. Therefore, mass gatherings may lead to the introduction of the virus into the community hosting the event and/or facilitate virus transmission and spread.

Measures to reduce the risk posed by mass gatherings include interpersonal distancing measures to avoid crowding and organisational measures, such as cancellation or postponement of an event. Data originating from seasonal and pandemic influenza models indicate that during the mitigation phase, cancellations of mass gatherings before the peak of epidemics or pandemics may reduce virus transmission. The cancellation of mass gatherings in areas with ongoing community transmission is, therefore, recommended. The decision to cancel will need to be coordinated by the organiser and public health and other national authorities. Alternative modes of broadcasting the events should be explored. In case mass gathering events take place, high risk individuals should be advised not to participate. Other personal protective and environmental measures should be implemented.

Due to the significant secondary effects (social, economic, etc.) of social distancing measures, the decision on their application should be based on a case-by-case risk assessment, depending on the impact of the epidemic and the local epidemiological situation [55].

Travel-related measures

Travel facilitates the spread of COVID-19 from affected to unaffected areas. Travel and trade restrictions during a public health event of international concern (PHEIC) are regulated under the International Health Regulations (IHR), part III.

Travel advice

When travelling it is best to avoid contact with sick persons, in particular those with respiratory symptoms and fever. Travellers should also practice good hand hygiene. Travellers who develop acute respiratory symptoms within 14 days of returning from areas with ongoing local transmission should be advised to seek immediate medical attention, ideally by phone first, and indicate their travel history to the healthcare specialist. Several EU/EEA countries have issued, or are considering, travel advice. Such advice will be less useful in scenarios 3-4, when ongoing community transmission is expected to occur in more places.

Travel restrictions

China, Italy and some other countries have used area quarantines, or so called 'cordon sanitaire' in addition to other measures on large cities, with the apparent effect on delaying the spread of this disease in China [16]. Apart from the experience in China and historical assessments of measures during the 1918 influenza pandemic, there is little evidence elsewhere to suggest that such measures would work against respiratory virus epidemics, unless implemented with such a rigour that there is absolutely no movement across the 'cordon' and there is very low prior transmission outside the 'cordon' [79].

Entry and exit screening of travellers

Screening for COVID-19 involves the use of thermal scanning and/or symptom screening. Available evidence suggests that entry and exit screening are not effective in delaying or mitigating a pandemic [55,80] or detecting incoming/outgoing travellers with infectious diseases.

Environmental cleaning and ventilation decontamination

ECDC has published an Interim guidance for environmental cleaning in non-healthcare facilities exposed to 2019-nCoV to provide options for environmental cleaning and decontamination in non-healthcare facilities (e.g. rooms, public offices, transports, schools, etc.) where COVID-19-confirmed cases have been before being diagnosed and/or admitted to hospital [81]. Although there is no evidence of the effectiveness of mechanical or natural air ventilation to reduce COVID-19 transmission, there is mechanistic plausibility, and it should be applied, and enhanced especially in settings where people gather regularly [73]. Increasing the frequency of cleaning and maintenance of ventilation and air-conditioning units can be considered.

Testing and surveillance strategy

Laboratory testing

Timely and accurate laboratory testing of specimens from cases under investigation is an essential part of the management of COVID-19 and emerging infections in general. However, any shortage of laboratory diagnostic capacity at national or local level will hamper epidemic response. If countries need help in testing, a pool of specialised referral laboratories have offered support within the EU/EEA [82]. Member States should monitor the changes in the epidemic situation and be prepared to adjust the laboratory diagnostic capacity to the changing needs. Anticipating a rapid increase in the demand, countries should continue rolling out primary diagnostic testing capacity to local clinical and diagnostic laboratories. The specimen types to be collected are listed in the WHO laboratory guidance [83].

When the diagnostic laboratories have established their SARS-CoV-2 detection assays and confirmed their first five positive and ten negative detection results with the national SARS-CoV-2 reference or international referral laboratories [83], the diagnostic laboratories can confirm the test results by the secondary target gene in their own laboratory. In countries with limited transmission or local clusters, positive specimens should be subjected to confirmation by targeting a second gene of SARS-CoV-2 in an RT-PCR assay.

In areas with local community transmission of COVID-19, detection by RT-PCR of a single discriminatory target is considered sufficient [83]. Confirmatory testing should be performed only for specimens where the first result is technically not interpretable or the RT-PCR cycle threshold value is above 35. In such a case, additional sampling or repeated testing and confirmation is advised. Serological assays are under development, and collecting serum specimens iat symptom onset, or at admission and at convalescent stage, or at discharge, will be useful for later seroepidemiological studies and should be done for hospitalised patients and during specific outbreaks such as in schools or confined facilities. Several commercial assays for SARS-CoV-2 are on the market, however, information on their clinical performance is still limited. Validation of the commercial assays is an urgent priority that some laboratories have started to address.

Influenza testing at least of hospitalised patients with severe acute respiratory infections (SARI) should be continued as long as local circulation of influenza continues in order to initiate early antiviral treatment of influenza-infected patients. The differential diagnostics are also key for isolation and contact tracing of COVID-19 cases.

Sentinel virological surveillance of outpatients with acute respiratory infections/influenza-like illness (ARI/ILI) for the monitoring of COVID-19 is recommended, based on the existing surveillance of influenza (see Surveillance section). A subset of patients should be swabbed based on geographical and population distribution. At regular intervals, a representative batch of positive specimens should be sent to a reference/referral laboratory for confirmation and further characterisation in order to identify and follow up the evolutionary changes of the virus. Testing specimens from sentinel outpatient surveillance sites for COVID-19 should be continued for as long as possible. In case of any shortages of sampling materials, oropharyngeal and nasopharyngeal swabbing can be performed with one swab and combined for one diagnostic test.

As per WHO biosafety guideline, non-propagative diagnostic laboratory work (for example, sequencing, nucleic acid amplification test [NAAT]) should be conducted at a facility using procedures equivalent to Biosafety Level 2 (BSL-2) and propagative work (for example, virus culture, isolation or neutralization assays) should be conducted at a containment laboratory with inward directional airflow (BSL-3). Patient specimens from suspected or confirmed cases should be transported as UN3373, 'Biological Substance Category B'. Viral cultures or isolates should be transported as Category A, UN2814, 'infectious substance, affecting humans' [84].

Countries should provide training to laboratory staff in laboratory diagnosis of SARS-CoV-2 as rapid expansion of laboratory diagnostic capacity is needed.

Shortages for laboratory testing for COVID-19

Based on a rapid, 24-hour turnaround survey on 4-5 March, to which 15 EU/EEA countries responded, the countries reported shortages on deliveries of swabbing material, plastic consumables, RNA extraction and RT-PCR reagents such as enzymes, primers, probes and positive control material. In addition, shortages of PPE such as respirators, surgical masks, gloves and disinfectants for laboratory use were reported. The primary reasons for shortages were production bottlenecks. Based on the information available and modelling of expected cases in Europe, laboratories should prepare themselves for critically increasing their testing volume. Shortages are not affecting only diagnostics of SARS-CoV-2 but also have an impact on other critical diagnostic testing for infectious diseases including screening for infectious pathogens for transplantation and beyond.

Optimising testing for COVID-19

Countries across the EU/EEA might be in different scenarios, even within the same country, and testing approaches need to be adapted to the situation at national and local level.

In scenarios 0 and 1, the strategy for testing should be in accordance with the ECDC case identification [85]. In addition, all patients with SARI requiring hospitalisation should be considered as suspected cases on admission and tested. As long as influenza is still circulating in the population, hospitalised patients with SARI should also be tested for influenza to initiate early antiviral treatment and separate them from other patients.

Once local transmission has been reported in the country or area (scenarios 2-4), as is the situation for most EU/EEA countries already or very soon, all patients presenting with symptoms of acute respiratory infection in primary care or the accident and emergency department of a hospital (first contact with the healthcare system) should be considered as suspected cases (considering also local influenza epidemiology). This may imply that a very large number of tests would need to be performed overwhelming testing capacity and priority groups will need to be established.

As a rational approach, the following should be considered for priority testing (in decreasing order of importance):

1. Testing of hospitalised patients with SARI in order to inform appropriate clinical management, including isolation and PPE measures;
2. Testing any cases of acute respiratory infection in hospitals or long-term care facilities (LTCF) in order to guide infection control and PPE use to protect both vulnerable persons and healthcare staff; testing of symptomatic healthcare staff to guide decisions on exclusion from and return to work; the aim is to protect health and social care services;
3. Testing of patients with ARI/ILI in sentinel outpatient clinics and among patients admitted to hospitals with SARI in order to assess virus circulation in the population.
4. Elderly people with underlying chronic medical conditions such as lung disease, cancer, heart failure, cerebrovascular disease, renal disease, liver disease, diabetes, and immunocompromising conditions exhibiting signs of acute respiratory illness should be prioritised for testing, given that they may more rapidly need respiratory support.

Healthcare workers should apply strict IPC measures when dealing with suspected cases (see below). During triage, suspected cases should be given a surgical mask and be directed to a separate area. Organising separate triaging areas or facilities in order to minimise contact between suspect cases and other patient groups should be considered. Such cohorting will also decrease the needs for PPE for staff. In South Korea and some EU/EEA countries, drive-in facilities for testing have been established.

Surveillance

Surveillance for COVID-19 is currently based on the EU case definition for probable and confirmed cases, which was updated on 02 March 2020 [86] and is in line with the updated case definition of the World Health Organization from 27 February 2020 for the global surveillance for human infection with COVID-19 [85]. The definition for a suspected case includes: people with ARI coming from an area with local transmission or contact with a confirmed case, as well as all SARI cases with no other aetiology irrespective of travel history or contact with a confirmed case. The inclusion of hospitalised (including specifically ICU-admitted) patients with SARI irrespective of travel history or residence in areas with localised (or more widespread) transmission in the EU/EEA in the case definition is essential at this stage of the epidemic and fully supported by ECDC. Cases that fit the probable or confirmed criteria of the case definition should be reported through TESSy. Variables collected are based on the WHO case reporting form [87,88]. Data have been collected since January 2020. ECDC also intends to start collecting data on the total number of tests performed for COVID-19 overall and the number of positive tests, in sentinel outpatient settings and among hospitalised patients with SARI.

Considering that countries are rapidly progressing in their epidemics to scenarios 2-4, the current surveillance objectives include:

- monitor the intensity and geographical spread of COVID-19 in the population;
- detect nosocomial outbreaks;
- identify and monitor changes in risk groups;
- measure the impact on population and the healthcare system and to measure the impact of any mitigation measures.

These objectives can be addressed through different surveillance methods depending on the stage of the epidemic, existence of surveillance systems which can be repurposed for COVID-19 surveillance, and the availability of resources.

Surveillance of confirmed cases: although case finding based on the surveillance case definition might still be of benefit in areas with ongoing community transmission, limited resources for testing might mean that this cannot be comprehensive. Such surveillance is therefore unlikely to give a full picture of the epidemiology of COVID-19. Despite this, the data can be useful to assess risk groups and inform control measures. Surveillance systems should be able to capture information on affected healthcare workers. Surveillance of confirmed cases and national and international reporting of these data should therefore continue as long as possible. At this stage, it is likely that detailed reporting is not feasible and a reduced dataset should be used for case-based reporting at national level and in TESSy. Countries might also decide to collect aggregated data on confirmed cases at national level once the number of reported cases increases. These data can also be reported through TESSy. The number of samples tested for COVID-19 should also be collected.

- **Detection and assessment of community transmission:** Detecting community transmission of COVID-19 is challenging as the suspect case definition is based on travel links. Severe cases may present only when significant community transmission has already occurred and sentinel surveillance covers only a small proportion of the population and might not be sensitive enough to detect ongoing low-level community transmission. Approaches to detecting community transmission could include:

- **Telephone helplines:** data on calls to regional/national healthcare telephone helplines could be analysed to provide an indication of increases of ARI/ILI regionally and nationally. Statistical methods could be used to detect changes in trends. The helplines could also be used to sample a proportion of cases fitting the ARI/ILI case definition in order to provide indication of community transmission of COVID-19. In situations where community transmission is suspected to be occurring (e.g. SARI cases detected), the proportion of cases sampled could be increased temporarily to provide a more comprehensive assessment.
- **Enhanced local syndromic ILI/ARI-based surveillance:** once cases are detected without links to known areas with community transmission, the local level of community transmission of COVID-19 should be assessed. This assessment should include as many general practices in the defined geographical area (for example a municipality) as possible for a limited time period (such as two weeks). The general practices should sample a proportion of ARI/ILI cases irrespective of their travel history and these samples should be tested for COVID-19. Data on such investigations should be summarised and posted on EWRS to allow Member States to assess the risk of community transmission in the area. The results from these assessments can inform Member States on whether contact tracing is still a viable response in the area.

Sentinel syndromic and virological surveillance: with increasing transmission, it is likely that sentinel syndromic and virological surveillance will become increasingly more important in order to assess intensity and spread of infection. The number of outpatient sentinel sites should be increased to improve coverage of the population under syndromic surveillance. Data on the number of patients visiting with ILI/ARI symptoms will provide information on spread and intensity as well as the most affected age groups in primary care. These data should continue to be reported in TESSy according to the influenza protocol. Data on the number of COVID-19 tests performed and number of positive tests from sentinel surveillance should continue to be collected and reported in TESSy on a weekly basis within the COVID-19 reporting.

If healthcare authorities recommend that patients with ARI/ILI do not visit general practitioners, there could be a significant impact on ARI/ILI surveillance systems, and sentinel surveillance might not be suitable to monitor COVID-19 intensity and spread. In these circumstances, sentinel general practices consulted through telephone could report at least the number and proportion of telephone consultations due to ARI/ILI. In addition, sites where ARI/ILI patients are directed and tested (e.g. dedicated testing centres) should be included in the surveillance, although historical data will not be available for comparison. Monitoring of healthcare telephone helplines as described above, ideally with linked systematic sampling could be an alternative or complementary approach.

Depending on the resources, virological detection by RT-PCR assay could be reduced to single-gene target testing. For the specimens where the first gene test is technically not interpretable or the cycle threshold value is above 35, confirmation of positive results should be performed by a separate gene target or repeated sampling should be performed. The subset for virological characterisation including sequencing should include specimens representing different times, age groups, geographical areas of countries and different levels of clinical symptoms. If sequencing is not feasible in the short term during the epidemic, the specimens should be kept for later sequencing of a subset of viruses.

Hospital SARI surveillance: all hospitalised patients with SARI should be tested for SARS-CoV-2 virus irrespective of travel history in order to detect community transmission, detect nosocomial outbreaks and to monitor intensity and impact. Testing data on SARI cases and/or ICU SARI cases should be collected, either via comprehensive surveillance or sentinel hospitals. Data collected should include at a minimum the number of COVID-19 tests performed among patients with SARI and the number of positive tests. These data should be reported in TESSy on a weekly basis. Enhanced surveillance of SARI cases can be used to identify risk groups for COVID-19, risk factors for severe illness and poor outcome.

Indicators for monitoring: Countries should collect basic indicators from each region on transmissibility, seriousness and impact of the disease [89]. Transmissibility can be based on ILI/ARI rates, seriousness on hospitalisation or ICU admission rates and impact on how hospitals are coping with the burden of COVID-19 infections. The assessment of the impact on hospitals should be based on bed occupancy levels in hospitals and intensive care units, and the capacity for ventilation, and could use simple indicators such as 'capacity sufficient' or 'overwhelmed'. These indicators would inform decisions on social distancing and quarantine measures which would need to be taken in the context of large pressures on public health services. The indicators should be collated at national level and reported at EU level.

Excess mortality surveillance: Monitoring of all-cause or specific excess mortality is essential at this stage in order to assess the impact of the epidemic in addition to monitoring deaths among confirmed cases.

Dissemination of surveillance data: Results from surveillance activities should be reported regularly to stakeholders and policy makers in order to inform control strategies. During the initial phase, extremely high demand for information from the public, stakeholders and policy makers will mean that daily reports or regularly updated dashboards are required. Weekly surveillance reports should also be developed collating data from multiple surveillance sources, including ARI/ILI sentinel surveillance, SARI surveillance, virological surveillance, case-based surveillance (as long as this is implemented), mortality data and qualitative indicators on the burden in hospitals and intensive care units. At the EU level, similar reports will be produced only a weekly basis and published on the ECDC website.

Limited resources: in general, surveillance data should continue to be collected at the most detailed level possible as long as capacity allows, in order to provide the best evidence for control interventions. When resources are limited, countries should move to more limited datasets as described above and eventually to aggregate reporting where this reduces burden.

A number of countries have reported shortages of laboratory reagents and resources for COVID-19 testing. Such shortages could become more acute in the context of large increases in cases. In circumstances with shortages, testing capacity should be reserved for more severe cases and hospital use and SARI cases.

If there is no capacity for testing of samples from sentinel clinics, sentinel syndromic surveillance for ARI/ILI through sentinel general practices and/or telephone helplines should be used to assess the intensity and spread of infection. This might be challenging if influenza and/or other respiratory pathogens are co-circulating. If testing capacity remains in hospitals or intensive care units, then SARI/ICU surveillance should be used for surveillance purposes. In the event that no testing capacity remains at all in hospitals, the qualitative indicators described above could be used.

Contact tracing

ECDC has published a technical report and algorithm on public health management of persons having had contact with probable and confirmed cases of COVID-19 infection [90]. ECDC have also produced a technical report for EU/EEA countries public health authorities with an estimation of resources required – including staff needs and coordination – for contact tracing, quarantine and monitoring activities [79]. The steps and resources needed are outlined in more detail in these documents.

The purpose of tracing COVID-19 case contacts is to identify symptomatic contacts as early as possible for testing, isolation and treatment. For contact tracing purposes, a contact is defined as a person who has or may have been in contact with a COVID-19 case in the period from 24 hours before the onset of symptoms until the time of diagnosis and isolation of the case. The classification of contacts according to high or low-risk exposure is based on the associated risk of infection that in turn determines the type of monitoring as defined in the ECDC technical document [90]. Data on contact tracing investigations should be collated and analysed at local and/or national level in order to learn from investigations and inform guidance.

In scenario 2, contact tracing, quarantining and monitoring is still a valuable part of a range of public health measures and should be intensified if possible. As the number of cases and their contacts increase as the country moves towards scenario 3, resources may be stretched, but there is still value in tracing contacts even if not all contacts of each case are traced. This will help slow the spread of infection but should be applied together with other measures, such as social distancing, as these different strategies can have synergistic effects [91-93]. The ECDC technical report outlines some ways to save resources such as using well-trained non-technical staff, and switching to self-monitoring [79]. If resources are limited, contact tracing and follow-up can be prioritised, first to the high-risk exposure contacts of each case (close contacts), contacts that are healthcare workers or work with vulnerable populations, followed by as many as possible of the low-risk exposure contacts [79].

In scenarios 3 and 4 contact tracing, where possible, could still contribute to delaying the spread and reducing the pressure on the healthcare system, and may be prioritised according to the principles outlined above. According to the WHO-China joint mission report, China put substantial resources into contact tracing during the outbreak [16]. Different locations within each country may have different transmission scenarios simultaneously, and contact tracing is particularly important in newly infected areas and should be done as extensively as possible here [94].

With regards to contact tracing of healthcare workers, as community transmission becomes more widespread and exposure of HCWs more frequent, countries should consider that resources may be better spent on other infection prevention and control activities in the healthcare setting. In this scenario, healthcare facilities can move towards more routine practices with regular self- or active monitoring of all healthcare workers for symptoms [95].

Please refer to the ECDC technical report and algorithm on public health management of persons having had contact with probable and confirmed cases of COVID-19 infection for further details on the specifics of contact tracing, isolation and monitoring for contacts, including specific guidance for healthcare workers [90].

5. Substances of human origin safety

Threats and risks posed by COVID-19 to the safety and sustainability of substances of human origin (SoHO) supply as well as response measures stay the same as assessed in the fifth update of ECDC rapid risk assessment. In the situation of increased spread of COVID-19 and extensive public health measures in the EU/EEA, SoHO authorities and establishments should focus and prioritise their efforts in managing the national SoHO supply. In this respect and in accordance with previously suggested principles [96], countries should:

- Ensure the inclusion of the SoHO national competent authorities (NCA) and/or establishment representatives in the national COVID-19 outbreak contingency planning body.
- Establish a mechanism for the SoHO NCAs and establishments to receive regular, up-to-date epidemiological information on the spread of COVID-19 in the country and abroad. Daily outbreak situation updates are available at the ECDC internet page for EU/EEA Members States and UK and for countries worldwide.

- Develop national/regional contingency plans for blood cells and tissues supply, which is reviewed constantly, regarding:
  - Risk of transmission of COVID-19 by SoHO which remains theoretical but cannot be completely excluded.
  - Temporary loss of donors resulting in a reduced supply. Donors may be unable to donate because of having COVID-19, the isolation or self-isolation after contact with confirmed case of COVID-19, work commitments, restricted public transportation, the need to care for family members, or reluctance to donate due to fear of being infected. Organising blood drives may be discouraged as part of measures to prevent people gathering. COVID-19 specific donor selection criteria could also in some extent contribute to the decrease in collections. Despite possible measures taken to reduce the mobility of persons, blood donation and blood collection are essential activities for the national health services; blood donation should preferably be made by appointment.
  - Temporary loss of staff due to COVID-19. It is anticipated that absenteeism during a COVID-19 outbreak will be higher than routine daily absenteeism, although the magnitude of absenteeism will depend on the on the local magnitude of an outbreak.
  - Changes in the clinical demand for blood and blood products, cells and tissues, reduction in demand due to a probable reduction in elective healthcare and postponing non-essential cells and tissues therapies. Implementation of Patient blood management (PBM), thorough evaluation of the appropriateness of blood component requests and a reduction of elective (which can be postponed as non-essential) surgery/healthcare with medium-high consumption of blood components is strongly advisable.
  - Work with national health authorities, hospitals and other responsible bodies to determine and monitor expected blood, plasma-derived medicinal products, cells and tissues usage during COVID-19 outbreak and to plan donation activities accordingly.
  - Changes in the local and general epidemiological situation in the country.
- Support SoHO establishments in developing and implementing business continuity plans (BCP) related to COVID-19 outbreak. The BCP objectives may consider:
  - Activate the BCP and set up a Business Continuity Management Team (BCMT) representative of the key functions and decision makers. Nominate a point of contact and a deputy with the Health Service and other agencies. This could be the Risk Manager.
  - Implement measures to reduce transmission of the COVID-19 among employees, customers/clients, and partners.
  - Minimise illness among employees.
  - Maintain critical operations and services by:
    - Reviewing stocks of critical supplies and increase supplies where possible
    - Regularly check with contingency partners to ensure that they can fulfil their commitments
    - Changing how staff are deployed, i.e. arrangements in offices/laboratories, cease non - essential meetings, minimise gatherings of staff, have meetings by teleconference even when in the same building, review catering arrangements and stagger staff dining, look at split shifts in the laboratories especially where there is no external contingency in place with no crossover to minimise the risk of passing on the virus, have as many of the critical staff work from home if that is possible, retrain staff to provide extra cover, bring back recently retired staff if necessary to fill essential roles, cease non-essential travel etc.
  - Communicate regularly with staff so that they feel assured that the situation is being managed and that you will inform them as the situation changes. Staff should be clearly informed about procedures after a direct contact with staff who tested positive for COVID-19 as well as need for self-isolation and social distancing.
  - Minimise social disruptions and the economic impact of the outbreak.
- Communication between SoHO establishments, NCA, national health authorities, ECDC and European Commission is essential to facilitate adequate and proportional response to COVID-19 outbreak at local, national and EU/EEA level. The alert platforms hosted by the European Commission for communication between Member States' SoHO authorities, Rapid Alert Blood (RAB) and Rapid Alert Tissues and Cells (RATC) platforms may be used for the communication between NCAs, EU commission and ECDC in order to share data on implemented measures and difficulties in supply.

According to the previous ECDC risk assessment and in the absence of evidence of COVID-19 transmission through organ transplantation, precautionary measures should be applied to prevent possible transmission to recipients, organ procurement and patient treating personnel. Deceased donors who have died with COVID-19 are not eligible for organ donation. Living organ donors potentially exposed to risk of being infected due to travel to area or being in contact with COVID-19 case should be tested for the presence of the virus or deferred from donation for 14 days after exposure. After recovery form COVID-19 disease, living donors are eligible for donation if tested negative or 14 days after recovery. Additionally, organ transplantation authorities should develop measures for management of organ recipients with COVID-19, procedures when the transplant centre is temporarily closed, isolation of recipients if transplanted during a potential incubation period or in an area with sustained community transmission country in order to protect the patient, family and hospital personnel. It is also important to keep uninterrupted national and international transportation of organs and other cells and tissues intended for transplantation.

6. Research needs

In the current situation of the outbreak it is crucial to investigate the availability and impact of countermeasures for public health actions and clinical management. Research on most affected populations or risk groups are also required to improve case management for the prevention of severe and fatal outcomes. It is important to understand the relative efficiency and relevance of the different modes of transmissions (e.g. droplets versus airborne, surfaces, or faecal-oral). Molecular studies could shed more light on disease dynamics and COVID-19 evolution and spread. Prevention and control measures include the development of vaccines and antiviral treatment options, which also have an implication on the management of cases and clinical measures. Several clinical trials for different products and pharmaceutical substances are currently conducted, which require continuous funding and harmonised approaches. To boost global preparedness, prevention and containment of the virus, new funding worth €232 million will be allocated to different sectors from the European Commission [97]. The European Commission funds the EU research and innovation programme up to €45 million of the Innovative Medicines Initiative fast track call for research proposals in response to the COVID-19 outbreak [98]. ECDC is in collaboration or will establish collaboration with projects such as Rapid European COVID-19 Emergency research Response (ReCoVer), and I-Move.

Available study protocols to conduct 'First few hundred', household transmission or other studies are available from WHO and should be applied. Results should be made available as soon as possible.

Engagement and efforts should also include serological studies to analyse the impact on a population level and compare with potential pre-existing immunity in the population. Such studies require sensitive and reliable serological tests, which are currently under development requiring validation. Study protocols are currently being developed and should be conducted in a harmonised way across the EU/EEA.

The assessment of the effectiveness of PPE in various settings will help provide more evidence regarding the prevention of transmission in healthcare settings and in particular how to protect healthcare workers.

Finally, modelling studies assessing effectiveness of interventions and policies aimed at delaying disease transmission could be of key importance to support decision-making and spare hospital capacity.

7. Limitations

This assessment is undertaken based on facts known to ECDC at the time of publication. There is substantial uncertainty regarding the epidemiological characteristics of the COVID-19. There is limited epidemiological and clinical information on the cases of COVID-19 identified so far (e.g. efficiency of different modes of transmission, proportion of mild and asymptomatic cases, transmission during incubation and recovery period, effectiveness of treatment regimes, risk factors for severe illness besides age, effective preventive measures). Given these limitations, ECDC will revise the current risk assessment as soon as more information becomes available.

8. Source and date of request

ECDC internal decision, 9 March 2020.

9. Consulted experts

ECDC experts (in alphabetic order): (10)(2e), Leonidas Alexakis, (10)(2e), (10)(2e), (10)(2e), (10)(2e), (10)(2e), (10)(2e), (10)(2e), (10)(2e), (10)(2e), (10)(2e), (10)(2e), (10)(2e), (10)(2e), (10)(2e), (10)(2e), (10)(2e), Margot Einöder-Moreno, (10)(2e), Joana Gomes Dias, (10)(2e), (10)(2e), (10)(2e), (10)(2e), (10)(2e), (10)(2e), (10)(2e), (10)(2e), (10)(2e), (10)(2e), (10)(2e), (10)(2e), Otilia Mårdh, (10)(2e), (10)(2e), (10)(2e), (10)(2e), (10)(2e), (10)(2e), (10)(2e), (10)(2e), (10)(2e), (10)(2e), (10)(2e), (10)(2e), (10)(2e).

10. Disclaimer

ECDC issues this risk assessment document based on an internal decision and in accordance with Article 10 of Decision No 1082/13/EC and Article 7(1) of Regulation (EC) No 851/2004 establishing a European centre for disease prevention and control (ECDC). In the framework of ECDC's mandate, the specific purpose of an ECDC risk assessment is to present different options on a certain matter. The responsibility on the choice of which option to pursue and which actions to take, including the adoption of mandatory rules or guidelines, lies exclusively with the EU/EEA Member States. In its activities, ECDC strives to ensure its independence, high scientific quality, transparency and efficiency.

This report was written with the coordination and assistance of an Internal Response Team at the European Centre for Disease Prevention and Control. All data published in this risk assessment are correct to the best of our knowledge at the

time of publication. Maps and figures published do not represent a statement on the part of ECDC or its partners on the legal or border status of the countries and territories shown.

Annex 1. Scenarios to describe progression of COVID-19 outbreaks

The following five scenarios, adapted from ECDC's strategic analysis, are used to describe the possible progression of the COVID-19 outbreak in EU/EEA countries.

Scenario 0 describes a situation with no reported cases in the country and multiple introductions and/or community transmission elsewhere in Europe. At this stage, the main objective for public health measures should be to enable rapid detection and isolation of individual cases to prevent domestic transmission chains, and to prepare for the response once cases are detected in the country.

Scenario 1 describes a situation with multiple introductions but limited local transmission in the country. Despite the introductions there is no apparent sustained transmission (only second generation cases observed or transmission within sporadic contained clusters with known epidemiological links). In this situation, the objective is containment of the outbreak by blocking transmission opportunities, through early detection of imported and locally-transmitted COVID-19 cases in order to try to avoid or at least delay the spread of infection and the associated burden on healthcare systems. Delaying the start of local transmission will allow the current influenza season to end, freeing up some healthcare capacity.

Scenario 2 describes a situation with increasing number of introductions and of more widespread reports of localised human-to-human transmission in the country (more than two generations of cases outside of sporadic clusters with known epidemiological links). In this situation, the objective remains to contain where practicable and otherwise slow down the transmission of the infection. This will increase the time available for development, production and distribution of PPE and effective therapeutic options, and would play a crucial role in reducing the burden on the healthcare system and other sectors, particularly if wider transmission of COVID-19 is delayed beyond the ongoing influenza season. A reduced burden would also allow for more time to increase laboratory capacity, and increase surge capacity in healthcare services. All these measures will facilitate effective treatment of infected patients [44]. Rapid collection and analysis of epidemiological and virological data will enable targeting of measures in this scenario and later.

Scenario 3 describes a situation with localised outbreaks, which start to merge becoming indistinct. In this scenario, there is sustained human-to-human transmission in the country (more than two generations of cases outside of sporadic clusters with known epidemiological links) and an increasing pressure on healthcare systems. The objective at this stage is to mitigate the impact of the outbreak by decreasing the burden on healthcare systems and protect populations at risk of severe disease. At the same time, operational research should guide developing better and more efficient diagnostic and treatment options.

Scenario 4 describes a situation with widespread sustained transmission where healthcare systems are over-burdened due to a large demand for emergency healthcare services, a strained ICU capacity, overworked healthcare workers and reduced staff availability due to illness, lack of PPE and lack of diagnostic testing capacity. The objective at this stage is still to mitigate the impact of the outbreak, decrease the burden on healthcare services, protect populations at risk of severe disease and reduce excess mortality.

Annex 2

Table. COVID-19 14-day cumulative notification per 100 000 population by country as per 11 March 2020 and prevalence levels associated with a > 90% risk of saturation of ICU beds

	Number of COVID-19 cases, 11 March 2020	Max 14-day cumulative notification/100 000 population (1)	Prevalence of hospitalised cases per 100 000 population associated with >90% risk of excess of ICU capacity (2)
Austria	182	2.03	17.7 [10.6, 58.1]
Belgium	267	2.33	24.1 [14.6, 78.1]
Bulgaria	4	0.06	49.7 [30.3, 160.4]
Croatia	13	0.29	20 [11.7, 67.1]
Cyprus	2	0.17	36.1 [20.3, 127.6]
Czech Republic	63	0.59	40.4 [24.8, 130]
Denmark	264	4.55	ND
Estonia	13	0.98	21.1 [11.7, 74.9]
Finland	40	0.71	18.2 [10.7, 60.7]
France	1 784	2.64	8.2 [5, 26.1]
Germany	1 296	1.54	19.1 [11.9, 60.3]
Greece	90	0.84	16.2 [9.8, 53.1]
Hungary	12	0.12	20.1 [12.1, 65.5]
Iceland	70	19.80	39.8 [21, 149]
Ireland	35	0.72	5.6 [3.1, 20]
Italy	10 149	16.26	11.7 [7.2, 37.1]
Latvia	8	0.42	27.1 [15.7, 93.2]
Liechtenstein	1	2.64	ND
Lithuania	3	0.11	26.4 [15.4, 89.1]
Luxembourg	7	1.15	50.7 [28.3, 179]
Malta	4	0.83	15.2 [7.5, 60.4]
Netherlands	382	2.22	9.3 [5.6, 30.6]
Norway	277	5.21	14.6 [8.6, 49.3]
Poland	22	0.06	11.9 [7.3, 38]
Portugal	41	0.40	11.3 [6.7, 37.4]
Romania	25	0.13	45.7 [28.2, 145.3]
Slovakia	7	0.13	65.2 [39.8, 210.6]
Slovenia	31	1.50	18 [10.1, 62.8]
Spain	1639	3.49	17.8 [11, 56.7]
Sweden	326	3.19	ND
United Kingdom	373	0.54	6.7 [4.1, 21.5]
Total	**17 430**	**3.28**	NA

(1) The 14-days cumulative notification rate per 100 000 population reflects the number of active COVID-19 cases per 100 000 population (proxy of COVID-19 prevalence) and the pressure on the healthcare system, even though the proportion of hospitalised cases is unknown and varies strongly by country due to differences in diagnostic testing policies; (2) Prevalence of hospitalised cases per 100 000 population associated with >90% risk of excess of ICU capacity based on modelling performed by ECDC (see text in disease background chapter); prevalence figures per 100 000 are given for three levels of hospitalised patients requiring ICU care: 18% [30% - 5%]. NA: no data.

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