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.