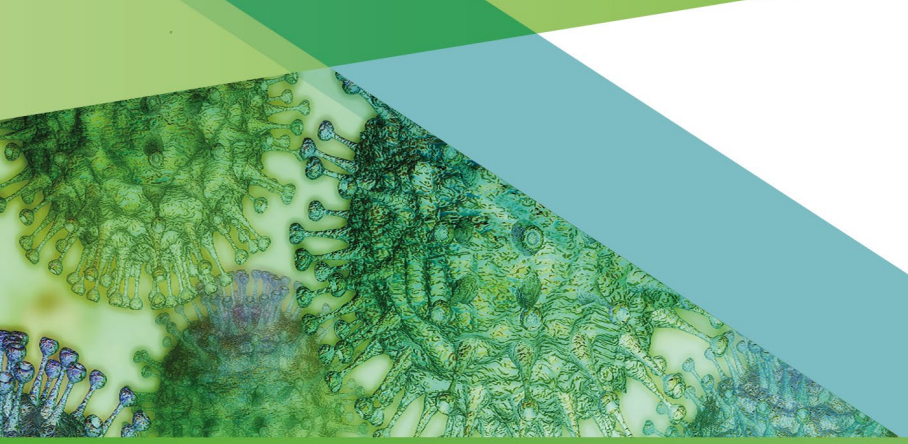

Considerations for infection prevention and control practices in relation to respiratory viral infections in healthcare settings

6 February 2023

Key messages

High levels of community transmission and the co-circulation of respiratory viruses, such as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), influenza, respiratory syncytial virus (RSV) and others can increase pressure on healthcare systems. These co-circulating viruses pose a challenge for the management of large numbers of patients with respiratory viral infections and have a tendency to cause outbreaks in healthcare settings. These outbreaks often result in severe consequences for hospitalised patients with comorbidities and other risk factors for severe disease and death.

Maintaining and strengthening appropriate infection prevention and control (IPC) practices mitigates the spread of respiratory virus in healthcare facilities, especially during peak periods of hospital admission. Timely implementation of multi-layered interventions is the key to preventing further strain on hospital personnel and other resources. Such interventions should be based on a holistic approach, addressing risks from transmission of all respiratory viruses and not just SARS-CoV-2.

In healthcare facilities, the mainstay of IPC comprises administrative measures (such as triage and placement of patients), standard precautions (especially hand hygiene), appropriate use of personal protective equipment (PPE) and environmental measures (such as cleaning and ventilation).

Testing for the early detection of COVID-19, influenza and RSV cases facilitates both the management of patient admissions and appropriate room and bed allocation in accordance with IPC recommendations.

Universal screening, by testing all patients for SARS-CoV-2 on admission to the hospital irrespective of symptoms to reduce the risk of onward transmission from asymptomatic patients, has limited additional benefit. It may be considered during periods of high community transmission of SARS-CoV-2, in particular by targeting high-risk vulnerable groups (e.g. patients admitted to oncology, transplantation units, etc.) or in the event of emerging viruses with high impact (e.g. emerging SARS-CoV-2 variants with high morbidity and mortality).

Ideally, patients with confirmed respiratory viral infection, or probable respiratory viral infection with confirmatory test results pending, should be placed in a single room. If the number of cases exceeds the single-room capacity, patients with the same viral infection can be placed in the same room (cohorting). Patients with co-infections involving two (or more) respiratory viruses, immunocompromised patients, patients with pronounced symptoms and those requiring bedside procedures associated with a high risk of transmission should be prioritised for placement in single rooms.

During periods of high community transmission of respiratory viruses such as SARS-CoV-2, influenza and RSV, in addition to appropriate hand and respiratory hygiene, staff, visitors and patients in both primary and secondary healthcare settings should be advised to wear medical face masks (universal masking) in common areas of the hospital, patient rooms and other areas where patient care is provided.

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Alternatively, during periods of high community transmission, healthcare workers in contact with patients should wear a medical face mask during all routine patient care (targeted clinical masking). Universal and targeted clinical masking can be discontinued when the period of high community transmission is over.

Decisions on implementation of universal or targeted clinical masking should take into account the expected benefit, as well as the burden on resources, staff, patients and visitors.

Healthcare facilities should ensure that PPE is available and appropriately used to safeguard staff providing patient care.

A risk assessment should be conducted to support appropriate selection of PPE. It is recommended that healthcare workers interacting with patients who have viral respiratory infections, without close proximity or long exposure to the patient, should wear a medical face mask, as a minimum. For prolonged contact in close proximity to the patient, including the performance of high-risk procedures, a well-fitted respirator (see 'Definitions') and eye protection are recommended. Gloves and a long-sleeve gown are recommended when there is a risk of exposure to body fluids and in settings where there is a high risk of exposure to respiratory viruses, such as when performing procedures with a high risk of transmission (also referred to as 'aerosol-generating procedures' - AGPs). If gloves and gowns are used, these should always be changed after contact with each individual patient.

In hospital rooms, it is recommended that floors should be cleaned regularly and that frequently-touched surfaces are disinfected using hospital disinfectants active against viruses. Ventilation is a key environmental measure for the prevention of respiratory viral infections in healthcare and other settings. The minimum number of air exchanges per hour, in accordance with national or hospital regulations, should be always ensured.

The decision to discontinue transmission-based precautions should be based on the time since symptom onset, the resolution of symptoms and other factors, such as the severity of disease, possible immunodeficiency and microbiological test results.

Scope

This document aims to support the development of guidance for healthcare facilities and healthcare providers in the European Union/European Economic Area (EU/EEA) on infection prevention and control (IPC) measures for the management of patients with respiratory tract viral infection in healthcare settings.

Target audience

National public health agencies, healthcare facility administrators, IPC and other professionals developing relevant IPC guidance and healthcare workers in EU/EEA countries.

Background

During the winter season in the northern hemisphere, high levels of community transmission and the co-circulation of respiratory viruses, such as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), influenza and respiratory syncytial virus (RSV), places pressure on healthcare systems. These co-circulating viruses pose a challenge for the management of large numbers of patients with infections and have a tendency to cause outbreaks in healthcare settings, often resulting in severe consequences for patients with comorbidities and other risk factors for severe disease and death. Furthermore, co-infections with multiple respiratory viruses have been observed, as is to be expected when more than one virus co-circulates, contributing to a prolonged duration or increased severity of such infections [1-5]. It is therefore important that healthcare facilities implement effective measures to appropriately manage these patients and mitigate the risk of respiratory virus transmission to healthcare staff, other patients and visitors. Such measures should be based on a holistic approach, addressing risks from transmission of all respiratory viruses rather than focusing solely on SARS-CoV-2. This document aims to provide some practical considerations, drawing on the experience of the COVID-19 pandemic and available evidence.

Surveillance and epidemiology

Several surveillance systems in place in the EU/EEA countries can provide information to healthcare professionals about the epidemiological situation in their countries and regions regarding the circulation of respiratory viruses.

According to recent guidance from ECDC and WHO's Regional Office for Europe, effective integrated surveillance systems are needed for influenza, COVID-19 and RSV, and potentially other respiratory virus infections.

Most EU/EEA countries operate sentinel surveillance systems in primary care based on a case definition of acute respiratory infections (ARI) or influenza-like illness (ILI), collecting information about the consultation rates by age group for syndromic monitoring in outpatient settings. Samples are taken from a subset of these patients and the samples are tested at national influenza centres (NICs) for respiratory viruses (mainly influenza virus, SARS-CoV-2 and RSV) to analyse the respective positivity rates and trend over time. Supplementary data that contribute to a better understanding of the level of virus circulation in a country include syndromic monitoring in non-sentinel sites; hospital bed occupancy; primary care laboratory analyses and event-based surveillance (e.g. outbreak analyses). For the assessment of the epidemiological situation, hospital admission rates and bed occupancy for respiratory virus infections remain practical and reliable indicators, although not established and reported from all countries or for all respiratory viruses.

A few EU/EEA countries have sentinel hospital surveillance of severe ARI (SARI) cases or laboratory-based hospital surveillance. Data are collected on a weekly basis and reported to The European Surveillance System (TESSy) at ECDC. Data are analysed and published weekly[1].

However, since the emergence of SARS-CoV-2 in 2019, EU/EEA countries operate COVID-19-specific surveillance systems, some of which are still in place. Weekly country overview reports are produced by ECDC based on data reported by EU/EEA countries to TESSy, including new detected cases, hospital and ICU admissions, hospital and ICU occupancy and deaths[2].

Since 2019, multiple waves of transmission and surges in COVID-19 cases have been observed in all countries, driven by the emergence of variants with increased transmissibility and the ability to evade infection-induced and vaccine-induced immune protection. Yet no clear seasonal pattern has been established for SARS-CoV-2, with year-round transmission occurring in all EU/EEA countries, driven by new variants and constantly emerging sub-lineages. There remains a potential threat of emerging SAR-CoV-2 variants having an impact on the epidemiological situation and healthcare burden caused by COVID-19 .

Lately in the EU/EEA, the overall epidemiological situation for COVID-19 has been improving compared to the substantial increases in the number of reported COVID-19 cases, hospital and ICU admissions and deaths reported by numerous countries during the year-end holiday period 2022. Similar declining trends in the incidence of RSV and influenza have also been observed in recent weeks, after an early start of seasonal activity for the 2022/2023 season.

Annual influenza epidemics usually occur between week 40 of one year and week 20 of the next. A threshold of 10% positivity of tested sentinel specimens is used to indicate seasonal activity and this usually starts between weeks 45 and 51, with a west-to-east spread [6]. Over the last decade, the peak of the seasonal influenza activity has been between week 52 and week 11, with a changing pattern of dominant virus types, subtypes or lineages each season and positivity rates of up to 60% for sentinel specimens. The COVID-19 pandemic disrupted influenza circulation, with very few detections during the 2020/21 season [7], resulting in a delayed and less intense epidemic during the 2021/22 season than in previous years [8]. The 2022/23 influenza season started early (week 45/2022) with widespread circulation and intensity levels comparable with pre-COVID-19-pandemic seasons, and with various influenza virus subtypes - i.e. A(H1N1)pdm09 and A(H3N2), and lineages (B/Victoria) circulating and affecting various age groups [9].

Before the COVID-19 pandemic, RSV epidemics in Europe used to have a clear annual seasonality with a west-to-east gradient at the season onset. Based on historical RSV surveillance data from 15 EU/EEA countries, all RSV seasons from week 11/2010 to week 16/2015 had a similar timing and epidemic course across Europe, with some variation within and between countries. Each year, the RSV epidemic in Europe progressed rapidly after week 40 (beginning of October) and the median start of the RSV season was in week 49 (beginning of December). The median length of the RSV season was 16−18 weeks, and the peak was around week 4 (end of January) [10]. The current 2022/2023 RSV season started early in comparison with the pre-COVID-19 pandemic seasons and peaked in weeks 46−47/2022 in primary care and in week 50/2022 in hospitals, with the number of RSV cases having since decreased. The population most affected by the RSV epidemic has been children aged 0–4-years. This season (2022/2023), several EU/EEA countries have reported increasing numbers of SARI due to RSV [11].

[1] Weekly data and analysis available at: https://flunewseurope.org/
[2] Weekly COVID-19 country overview reports available at: https://www.ecdc.europa.eu/en/covid-19/country-overviews

Transmission of respiratory viruses

In most instances, respiratory viruses are transmitted from person to person via inhalation of infectious respiratory particles or the depositing of these particles on mucosal surfaces. Transmission through contact with contaminated environmental surfaces and objects and subsequent transfer of infectious particles to the mouth, nose or eyes (fomite transmission) is also considered possible. There is no evidence that transmission can occur through intact or non-intact skin.

SARS-CoV-2 mainly spreads via respiratory droplets, including aerosols, from an infected person who sneezes, coughs, speaks, or breathes in close proximity to others [12]. Exposure may occur via the inhalation of respiratory droplets or aerosol particles, the depositing of respiratory droplets and particles on exposed mucous membranes (mouth, nose, eyes), and/or by touching the mucous membranes after contact with surfaces contaminated with infectious SARS-CoV-2 (fomite transmission). The relative risk of SARS-CoV-2 being transmitted via fomites is considered low compared with transmission through inhalation or mucosal deposit of respiratory droplets, including aerosols [13,14]. Numerous studies have investigated the length of time that SARS-CoV-2 can survive on various porous and non-porous surfaces. On porous surfaces (such as fabrics or paper), studies are unable to detect viable SARS-CoV-2 within minutes to hours of exposure to the virus. On non-porous surfaces (such as metal or plastic), viable SARS-CoV-2 has been detected several days after exposure. However, the amount of viable SARS-CoV-2 declines over time and it is rarely present on surfaces in sufficient amounts to cause infection via fomites [15].

There is evidence that COVID-19 cases with mild or no symptoms contribute to the spread of COVID-19 [16-20]. Although uncertainties remain about the relative role of such cases in SARS-CoV-2 transmission, this observation has significant implications for the prevention of COVID-19 among healthcare workers and vulnerable patient populations in healthcare [21].

Influenza virus is also transmitted through respiratory droplets, including aerosols [22,23], as well as via fomites (i.e. contact with contaminated surfaces and objects and transfer to the mucosal membranes of the respiratory tract and the eye). Although, influenza virus is detected in respiratory secretions one day before onset of symptoms, the risk of transmission prior to the onset of symptoms is considered low [24]. One study showed that influenza virus is mainly shed two-to-three days after symptom onset, while less than 10% of transmission events occur before symptom onset [25]. Among the cases with detectable virus shedding in this study, 14% were asymptomatic but had low viral shedding. In symptomatic individuals, viral shedding lasted on average 4.80 days (95% CI: 4.31-5.29) [26].

Transmission of zoonotic influenza viruses (avian or swine influenza mainly) is related to direct unprotected exposure to infected animals (e.g. during outbreaks at poultry farms, exposure to infected wild birds or pigs or a contaminated environment). Human infections with zoonotic influenza viruses are rare events and human-to-human transmission events have very rarely been observed [27].

RSV is considered as being primarily transmitted via large respiratory droplets, or contact with contaminated nasopharyngeal secretions on surfaces and objects followed by auto-inoculation, mainly through the eyes and nose (fomite transmission). RSV can survive on hands for up to 25 minutes and for longer periods on gloves, gowns, paper tissues and other surfaces [28]. In addition, a recent study found evidence of the presence of RSV in respiratory aerosols in rooms with hospitalised infants [29]. The incubation period is approximately five days, and the period of shedding is one week, although longer periods have also been documented, especially in young children and immunocompromised patients [28]. Unrecognised asymptomatic RSV individuals also appear to play a role in the transmission of RSV within the household and the community [30].

Infection prevention and control measures

Maintaining and strengthening IPC practices can mitigate the spread of pathogens within healthcare facilities, especially during peak periods of hospital admission. Timely implementation of multi-layered interventions is the key to preventing further strain on hospital personnel and other resources. Hospital management should ensure adherence to IPC measures and adequate availability of resources, such as PPE.

Due to the likelihood of respiratory virus transmission by people with few or no symptoms, healthcare facilities should ensure that physical distancing measures are applied by staff, visitors and patients, particularly in common areas during periods when there is community transmission of respiratory viruses [31].

Administrative measures

Out-patient care

- Primary care practices and hospital out-patient clinics play an important role in controlling the spread of respiratory viruses. Testing for SARS-CoV-2 and/or other respiratory viruses has been widely performed for diagnostic or screening purposes since the COVID-19 pandemic started and the results could support the appropriate management of cases admitted to healthcare facilities. Patients should be asked to contact the primary care practice by phone in advance of a visit and inform them of any respiratory symptoms. If feasible, dedicated home visiting services should be considered for vulnerable patients to avoid crowded out-patient and emergency services [32].

Triage, initial contact and assessment

- Emergency services and primary care staff, including physicians, nursing and administrative staff who have contact with patients, should be made aware of:
  - the current epidemiological situation regarding the circulation of respiratory viruses in the community, their region and the country, in close collaboration with the public health authorities, as indicated by surveillance data (e.g. sentinel surveillance);
  - the recommended IPC measures for patients with confirmed and probable respiratory infection and the targeted IPC measures, depending on the aetiologic agent.
- There should be regular assessment of the onsite availability of appropriate PPE and alcohol-based hand rub dispensers and solution for all healthcare workers and other staff in contact with patients at the point of care.
- Patients with confirmed or probable respiratory viral infection awaiting test results should be provided with medical face masks to be worn at least when they are out of their room, or when other people are present in the room.
- Assessment and management of patients with respiratory symptoms should ideally be performed in a separate area of the emergency department. This should allow for the rational use of PPE and the safer collection of diagnostic respiratory samples.
- Other types of exposure (such as travel and contact with animals) should be also considered to allow for prompt testing and isolation of patients with risk factors for infections of high impact such as avian influenza, swine influenza and MERS-CoV.

Testing

- Rapid antigen detection tests (RADTs) or point-of-care/near-patient tests available for SARS-CoV-2, influenza and - particularly in paediatric care - RSV (separate or combined) for patients with respiratory infection symptoms at emergency departments or entry points to healthcare facilities should be used to support clinical decisions (e.g. triaging, level of protection, isolation and early initiation of antiviral treatment). Early detection of COVID-19, influenza and RSV cases facilitates the optimal management of admitted patients and the appropriate room/bed allocation, in accordance with IPC recommendations.
- Hospitalised patients who present symptoms indicative of respiratory tract infection (fever, cough, sore throat, rhinorrhea) should be tested promptly for respiratory viruses, primarily through molecular tests (e.g. PCR or other NAAT) or point-of-care/near-patient tests, when available. For the diagnosis of SARS-CoV-2 and influenza, a validated rapid antigen detection test (RADT) should be considered to ensure the timely application of IPC measures to prevent onward transmission.
- Universal screening by testing all patients for SARS-CoV-2 on admission to the hospital, irrespective of symptoms to reduce the risk of onward transmission by asymptomatic patients has limited additional benefit [33-36]. It may be considered during periods of high community transmission of SARS-CoV-2, in particular by targeting high-risk vulnerable groups (e.g. patients admitted to oncology, transplantation units, etc.) or in the event of emerging viruses with high impact (e.g. emerging SARS-CoV-2 variants with high morbidity and mortality). However, there is no evidence that universal screening prevents transmission of other respiratory viruses in healthcare settings. The implementation of either universal screening of all patients on admission to a hospital or targeted testing should be carefully assessed, considering the level of local community transmission and the overall burden of the screening programmes on staff and other resources [34,37].
- During periods of high community transmission, the testing of patients identified as contacts of SARS-CoV-2, influenza or RSV cases can be considered as a measure to mitigate onward transmission [38,39], especially during hospital outbreaks and when patients are placed in shared rooms.

- Ensuring laboratory capacity and availability of laboratory testing for respiratory viruses, and prioritising the timely availability of test results to confirm initial rapid antigen test results will provide more information on viral (sub)types/lineages (influenza) or variants/lineages/sub-lineages (SARS-CoV-2).
- Specimens from patients with respiratory symptoms (upper and lower respiratory tract specimens - e.g. combination of deep oropharyngeal and mid-turbinate specimens) should be tested using multiplex nucleic acid amplification tests to simultaneously detect SARS-CoV-2, influenza, RSV and other respiratory viruses where possible. This will facilitate prompt clinical management and implementation of IPC measures, such as patient placement.
- ECDC testing guidance is available for the identification of zoonotic influenza infections[3].

In-patient care

- **Standard precautions** and, in particular, meticulous hand and respiratory hygiene are the key to preventing the transmission of respiratory viruses and should be applied for all patients.
- Due to the likelihood of respiratory virus transmission by people with few or no symptoms, healthcare facilities should ensure that physical distancing measures are applied by staff, patients and visitors, particularly in common areas during periods where there is community transmission of respiratory viruses [31].
- In addition to observing appropriate hand hygiene and respiratory hygiene measures, during periods where there is high community transmission of respiratory viruses such as SARS-CoV-2, influenza and RSV, staff, visitors and patients in primary and secondary healthcare settings should be advised to wear medical face masks (universal masking) in common areas of the hospital, patient rooms and other areas where patient care is provided [40].
- Alternatively, during periods of high community transmission, healthcare workers in contact with patients should wear a medical face mask during all routine patient care (targeted clinical masking).
- Universal and targeted clinical masking can be discontinued when the period of high community transmission is over.
- Decisions on the implementation of universal or targeted clinical masking should take into account the expected benefit, as well as the burden on resources, staff, patients and visitors.
- **Transmission-based precautions** should be applied for patients with confirmed respiratory viral infection, taking into consideration the microorganism, as well as factors that can affect transmissibility such as the time and proximity of contact, the need for high-risk procedures, the immune status of the patient and the clinical presentation. Where feasible, transmission-based precautions should also be considered for patients with probable respiratory viral infection (e.g. patients with typical clinical presentation or with an epidemiological link to a confirmed case).
- Patients with a confirmed respiratory viral infection, and those with probable respiratory viral infection awaiting confirmatory test results, should ideally be placed in a single room. They should wear a medical face mask when not alone in the room, if tolerated, and practice appropriate hand and respiratory hygiene. If possible, dedicated toilet facilities should be made available.
- If the number of patients with respiratory viral infections exceed the single-room capacity of the hospital/facility/ward, patients with the same viral infection can be placed in the same room (cohorting). Patients with co-infections involving two (or more) respiratory viruses, immunocompromised patients, patients with pronounced symptoms and those requiring bedside procedures associated with high risk of transmission should be prioritised for placement in single rooms. Cohorting of patients with suspected respiratory viral infection awaiting diagnostic confirmation alongside other patients with confirmed or suspected infection should be avoided.
- Patients diagnosed with respiratory viral infections that have pandemic potential or are high impact (MERS-CoV, avian influenza) should be prioritised for isolation in a single room or, if available, an airborne-precaution isolation room.
- Intubation for mechanical ventilation should be planned ahead and emergency intubations should be avoided as much as possible. Performing all the necessary procedures, such as central venous catheter and arterial line insertions, during one session should be considered, to conserve PPE.
- Measures to decrease the risk of respiratory virus transmission in healthcare settings include: ensuring appropriate ventilation in patient care areas (at least six air changes per hour in common wards); minimising the contact between patients; ensuring a distance of at least one metre between the beds and considering the use of physical barriers between patients.
  The use of dedicated (i.e. one for each patient), or if possible, disposable, medical equipment (e.g. blood pressure cuffs, stethoscopes and thermometers), is recommended for patients with COVID-19 or other viral respiratory infections.
- Visitors should be made aware of basic infection prevention and control precautions, including hand hygiene and respiratory etiquette. During periods of high community transmission, visitors should wear a medical face mask for the duration of the visit and, if feasible, screening of visitors for symptoms of respiratory infection should be considered. Visitors who have symptoms of respiratory infection should not be allowed to visit. Active awareness raising by hospitals and public health authorities should be considered. During periods of high community transmission or when there is a hospital outbreak of respiratory viral infection, visits may need to be restricted for a specific period of time, particularly in units/wards with high-risk patients, whilst still taking into account the well-being of patients who need some contact with family members. Any restrictions implemented should be regularly reviewed to determine if they are still required.

[3] ECDC testing guidance available at: https://www.ecdc.europa.eu/en/publications-data/zoonotic-influenza-virus-infections-humans-testing-and-detection

High-risk medical procedures ('Aerosol-generating procedures')

- Several medical procedures have been linked to increased risk of transmission of microorganisms, including respiratory viruses, transmitted through respiratory droplets and aerosols, presumably due to the increased aerosolisation of infectious respiratory secretions. Therefore these procedures require respiratory protection measures [41]. Such procedures are known as aerosol-generating procedures.
- Although the scientific evidence is often inconclusive, procedures that have been linked to increased risk of transmission of respiratory viruses include endotracheal intubation (particularly in non-anaesthetised patients), open suctioning, manual ventilation before intubation, non-invasive positive pressure ventilation, tracheotomy, cardiopulmonary resuscitation and bronchoscopy [42-44].
- Of these procedures, the one which scientific evidence has most consistently shown to be aerosol-generating is endotracheal intubation.
- The infectious risk of other procedures that have been linked to the production of aerosols, such as administration of nebulised treatment, is unclear and there is no consensus on their classification as aerosol-generating procedures [45].
- High-risk medical procedures in patients with respiratory viral infections should ideally be performed in a single room and, if possible, in a negative pressure airborne-isolation room. The number of people in the room should be limited to a minimum during such procedures. All those present should wear a well-fitted respirator (see 'Definitions'), goggles or a visor, a long-sleeved impermeable single-use protective gown and gloves [46].

Discontinuation of transmission-based precautions

The duration of transmission-based precautions for hospitalised patients [47] with COVID-19 or other respiratory viral infections should be decided taking into account a number of factors:

- clinical resolution or improvement of respiratory symptoms;
- time elapsed since onset of symptoms;
- severity of disease;
- immune status;
- occupational status and/or susceptibility of those with whom they have regular contact;
- social mixing factors;
- impact of further transmission (e.g. for high impact pathogens);
- evidence of negative RADT or RT-PCR test from the upper respiratory tract.

Any decision on the inclusion of a specific set of the above criteria should be aligned with the risk assessment of the healthcare facility, taking in account the availability of resources and the feasibility of implementing the measures. Evidence indicates that the infectivity of SARS-CoV-2, influenza and RSV starts before the onset of symptoms [48]. In symptomatic individuals with influenza, viral shedding lasts on average 4.80 days (95% CI: 4.31-5.29) and is considerably decreased after Day 5 from the onset of symptoms [26]. In adults with RSV infection, the average duration of RSV shedding was 3.9 days (range, 1–17 days) and this lasted less than seven days in more than 90% of cases [49]. For SARS-CoV-2, several studies show that most transmission happens around the onset of symptoms and that the virus can initially be detected in upper respiratory samples one to two days before the onset of symptoms. Viral shedding declines after the first two or three days from the onset of symptoms [50]. One study of contact tracing data showed that no transmission occurred later than the sixth day after symptom onset [51]. The dynamics of viral shedding depend on several factors, including previous vaccination and the SARS-CoV-2 variant [50]. Some patients with laboratory-confirmed COVID-19 infection have been identified as PCR-positive over prolonged periods of time after infection and clinical recovery [52,53], but their potential for onward transmission is unclear [54]. Prolonged viral RNA shedding has been shown even after seroconversion [55,56]. The identification of SARS-CoV-2 RNA through PCR (i.e. viral RNA shedding) does not equate to the presence of infectious SARS-CoV-2.

Based on the existing evidence for non-immunocompromised adult patients with COVID-19 and influenza, transmission-based precautions can be discontinued when the following criteria are fulfilled:

1) five days after the onset of symptoms and,
2) resolution of fever for at least 24 hours and,
3) clinical improvement of other symptoms.

Negative RADT or RT-PCR test results for SARS-CoV-2 can also be used to support the decision for discontinuation of transmission-based precautions in patients with COVID-19 [57]. In the event of prolonged RT-PCR positivity for SARS-CoV-2 (RNA shedding), high Ct values (≥30) could be used as a proxy of low likelihood of transmissibility, while low Ct values (<24) indicate a higher likelihood of transmissibility, with the caveat that these are not standardised thresholds and differ across laboratories. Wearing a respirator (see 'Definitions') or medical face mask until 10 days after the onset of symptoms or until a negative RADT test is obtained, can be considered as an additional measure.

For immunocompromised or severely-ill patients with respiratory viral infections, longer duration of transmission-based precautions may be necessary due to prolonged viral shedding. Decisions concerning the duration of such precautions should be taken based on clinical judgement and in consultation with IPC professionals. For COVID-19 patients, in addition to the above criteria, two consecutive negative RADT or RT-PCR test results for SARS-CoV-2, ideally with a minimum of a 24-hour interval, should be provided for the discontinuation of isolation, especially if the patient is to be transferred to another unit within the hospital, another hospital, or discharged to a long-term care facility (LTCF).

Similarly, for children hospitalised with influenza longer duration of transmission-based precautions may be necessary due to longer duration of viral shedding. Here too, decisions on the duration of precautions should be taken based on clinical judgement and in consultation with IPC professionals [58]. However, if clinical symptoms and situation allow, children should be discharged with advice on how to prevent transmission at home. For children, and particularly for infants with RSV infection, transmission-based precautions are ideally recommended for the whole duration of hospitalisation, due to prolonged viral shedding [59].

Healthcare workers and other healthcare facility staff, including occupational safety and health

- The safety and health of healthcare workers and other staff working at healthcare premises is paramount, not only for their own protection, but also to help prevent the spread of respiratory viruses and improve overall healthcare. There is a comprehensive body of EU legislation to protect workers' health and safety at the workplace. Additional measures that need to be taken when a surge of cases with respiratory viral infections is detected at healthcare premises may represent an additional burden and risk for the well-being of staff, in terms of higher physical and mental workloads, longer working hours and increased administrative workloads (Annex). Appropriate measures should be implemented by employers in accordance with the national legislation governing risks from biological agents at work and Directive 2004/54/EC on the protection of workers from exposure to biological agents [60]. Occupational safety and health (OSH) measures should be adapted in agreement with OSH services and workers, taking into account all types of risks as well as the additional physical load when wearing personal protective equipment (PPE). The safety and health committee should be consulted, if there is one at the healthcare facility.
- Hand hygiene and respiratory hygiene are the key to preventing the transmission of respiratory viruses and should be applied by all healthcare workers and other staff working in healthcare facilities.
- Appropriate training on recommended IPC measures for healthcare workers and other staff should be ensured and sustained.
- During periods of high community transmission, in addition to practising meticulous hand hygiene, all staff who provide care for patients or have contact with patients should wear a medical face mask as part of universal or targeted clinical masking policies [40].
- Staff members with symptoms compatible with a respiratory viral infection should be relieved of clinical duties and allowed to stay at home when sick and if feasible, consider being tested for SARS-CoV-2 and influenza. Staff with a respiratory viral infection may return to work after resolution of fever and improvement of other symptoms.
- Staff members with confirmed COVID-19 or influenza may return to work in accordance with relevant national advice or five days after the onset of symptoms, resolution of fever or clinical improvement of other symptoms. If feasible for COVID-19 cases, staff should obtain a negative RADT or RT-PCR SARS-CoV-2 test result before returning to work. If no testing is available or recommended, wearing a respirator (see 'Definitions') for five more days after onset of COVID-19 symptoms is recommended for health professionals.
- Healthcare workers should be advised on and offered vaccination against influenza and SARS-CoV-2 in accordance with national recommendations.
- Hospital management or preparedness plans should account for surge capacity procedures during periods of high community transmission and estimate the needs in terms of staff, beds, respiratory support devices and PPE, with prioritisation of ICUs due to high-risk patients and increased medical interventions. Laboratory capacity, including reagents and diagnostics, and therapeutics should also be included in these estimates.
- Workplace risk assessments should be regularly revised and the measures adapted to consider changes in work procedures that may incur an additional risk to staff. The latter includes higher physical and mental workload. Staff should be made aware of and trained to implement the surge capacity procedures.
- A strategy should be defined for testing, management and follow-up of healthcare workers with respiratory symptoms in accordance with national/regional authorities.

Personal protective equipment (PPE)

- For respiratory viral infections, including COVID-19, influenza and RSV, evidence shows that the use of face masks and eye protection are effective protective measures, although the results of studies are not uniform [61-64].
- Although infectious aerosols have been implicated in the transmission of respiratory viruses and respirators (see 'Definitions') are generally recommended for the prevention of infections considered to be primarily transmitted through aerosols (e.g. tuberculosis), studies comparing the effectiveness of respirators versus medical face masks for the prevention of respiratory viral infections have shown conflicting results. Experimental studies showed that respirators have better filtration characteristics, and some observational studies indicated that respirators are more effective than medical face masks [65]. However, randomised controlled trials have failed to confirm this [66,67]. Biases related to the observational studies, as well as the limitations of randomised controlled trials as regards possible exposure outside the trial setting mean that the certainty regarding the comparative effectiveness of respirators and medical face masks remains low. On the other hand, medical face masks do filter smaller droplets to some extent, which probably accounts for at least part of their efficacy in preventing respiratory viral infections [68].

- Prolonged contact and close proximity to a patient with a respiratory viral infection is linked to increased risk of transmission. Therefore a risk assessment can be applied to guide the selection of PPE depending on the planned procedure or other tasks.
- Healthcare workers caring for patients with a respiratory viral infection should apply standard precautions, including appropriate hand hygiene. Wearing a medical face mask is recommended, as a minimum, for contact with patients where there is no close proximity to the patient. For prolonged contact in close proximity to the patient, including the performance of high-risk procedures, a well-fitted respirator (see 'Definitions') and eye protection (e.g. goggles) are recommended. Gloves and a long-sleeved gown are recommended when there is risk of contact with body fluids and where there is a high risk of exposure to respiratory viruses - such as when procedures with a high risk of respiratory virus transmission (also referred as 'aerosol-generating procedures' - AGPs) are performed. Aprons can be used in place of gowns, especially when the risk of contact with body fluids is low. The gloves and the gown or apron should be changed between patient contacts.
- For RSV infections, particularly in infants, young children and immunocompromised adults, the use of gloves, gowns and face mask or eye protection (e.g. goggles) is recommended [59,69].

Environmental measures

The following measures should be considered to reduce the risk of transmission from environmental contamination:

Cleaning

- In hospital rooms, it is recommended that the floor is cleaned regularly and that frequently-touched surfaces are disinfected using hospital disinfectants active against viruses. If there is a shortage of hospital disinfectants, surfaces may be cleaned with a neutral detergent, then decontaminated with 0.05–0.1% sodium hypochlorite (i.e. dilution 1:100 to 1:50 if household bleach at an initial concentration of 5% is used). Surfaces that could be damaged by sodium hypochlorite may be cleaned with a neutral detergent, followed by 70% ethanol.
- Decontamination of non-single use medical devices should be carried out in accordance with the manufacturer's instructions. Use of dedicated equipment can be considered for patients with COVID-19 or other viral respiratory infections, when available, to avoid in-hospital transmission.
- Regular cleaning and disinfection of electronic equipment, such as mobile phones, desk phones and other communication devices, tablets, desktop screens, keyboards and printers should be ensured, particularly when these are used by many people (e.g. equipment shared by on-duty physicians, nursing staff, etc.).

Ventilation

- Ventilation plays a key role for the prevention of respiratory infections in healthcare [70] and other settings [71]. The minimum number of air exchanges per hour, in accordance with the applicable hospital regulations, should be always ensured. WHO recommends at least six air changes per hour in regular patient rooms [72]. Increasing the number of air exchanges per hour will reduce the risk of transmission in closed spaces. This may be achieved by natural or mechanical ventilation, depending on the setting. Air recirculation without proper filtration (e.g. by using high-efficiency particulate absorbing (HEPA) filtration) should be avoided as much as possible.
- Air filtration and ultraviolet germicidal irradiation (UVGI) are complementary approaches that can be applied in healthcare settings as a measure for the prevention of respiratory viral infections [71]. Such solutions can be considered in situations where it is difficult to ventilate adequately.

Waste management

- Staff engaged in waste management should be trained and provided with appropriate PPE which they should wear.
- Waste should be treated as infectious clinical waste Category B (UN3291) [73], and handled in accordance with healthcare facility policies and local regulations.

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Definitions

A respirator (also known as filtering face piece (FFP) mask or filtering half mask) is designed to protect the wearer from exposure to airborne contaminants (e.g. from inhaling infectious agents associated with inhaling small and large particle droplets) and is classified as personal protective equipment (PPE) [74]. FFP2 respirators have a filtering capacity of at least 94% for 0.3 µm particles. FFP3 respirators have a filtering capacity of at least 99% for 0.3 µm particles. Respirators are mainly used by healthcare workers to protect themselves, especially during aerosol-generating procedures, and require a fitting test to ensure proper protection. Some valved respirators do not prevent the release of exhaled respiratory particles from the wearer into the environment and therefore may not be appropriate for use as a means of source control in the case of respiratory infections [75]. Requirements for respirators are specified in EN 149:2001+A1:2009.

A medical face mask (also known as surgical or procedure mask) is a medical device covering the mouth, nose and chin, ensuring a barrier that limits the transition of an infective agent between hospital staff and the patient. They are used by healthcare workers to prevent large respiratory droplets and splashes reaching the mouth and nose of the wearer, and as a means of source control to stop the spread of large respiratory droplets by the person wearing them [74]. Requirements for medical face masks are defined in EN 14683:2014. Medical face masks are not defined as personal protective equipment in Regulation (EU) 2016/425 of 9 March 2016 and Directive 89/656/EEC on personal protective equipment. However, for the purposes of this document and in accordance with guidance on infection prevention and control in the context of COVID-19 by the World Health Organization (WHO) [76] and on transmission-based precautions [69], medical face masks are considered to provide protection against infections transmitted by droplets.

Community face coverings (or non-medical face masks, 'community' masks) include various forms of self-made and commercial masks, including re-usable face covers made of cloth, other textiles and other disposable materials, such as paper. They are not standardised and are not intended to be used in healthcare settings or by healthcare workers. The minimal requirements for reusable or disposable community face coverings intended for the general public are specified in CWA 17553 (European Committee for Standardisation – CEN) [77].

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Annex

Measures for the protection of workers from exposure to biological agents at the workplace are specified in the Directive 2004/54/EC (available from https://eur-lex.europa.eu/legal-content/EN/LSU/?uri=celex:32000L0054) and include:

- keeping the number of workers exposed or likely to be exposed as low as possible;
- design of work processes and engineering control measures so as to avoid or minimise the release of biological agents into the place of work;
- organisational measures to limit exposure, such as dedicated areas for the reception of infected patients;
- technical measures such as appropriate ventilation, physical barriers and the use of appropriate work benches for laboratory work;
- personal protective measures as a last resort, where the above-mentioned measures do not ensure appropriate protection;
- training of workers, including in the use of PPE, disinfection procedures and waste disposal;
- provision of appropriate PPE in adequate quantities;
- ensuring means for the safe collection, storage and disposal of waste by workers, including the use of secure and identifiable containers, after suitable treatment;
- ensuring that workers are provided with appropriate protective clothing or other appropriate special clothing;
- ensuring that workers are provided with appropriate and adequate washing and toilet facilities, which may include eye washes and/or skin antiseptics;
- ensuring that working clothes and protective equipment, including protective clothing, which may be contaminated by biological agents, are removed on leaving the working area and, before taking the measures referred to in the second subparagraph, so that they are kept separately from other clothing. The employer must ensure that such clothing and protective equipment is decontaminated and cleaned or, if necessary, destroyed;
- drawing up plans to deal with accidents and incidents and ensure that staff know whom to report to;
- the employer taking appropriate measures to ensure that workers and their representatives receive sufficient and appropriate training, concerning: (a) potential risks to health; (b) precautions to be taken to prevent exposure; (c) hygiene requirements; (d) wearing and use of protective equipment and clothing; (e) steps to be taken by workers in the case of incidents and to prevent incidents. The training shall be: (a) given at the beginning of work involving contact with biological agents, (b) adapted to take account of new or changed risks, and (c) repeated periodically if necessary.

Appropriate measures shall be taken in health and veterinary care facilities to protect the health and safety of the workers concerned. The measures to be taken shall include: (a) specifying appropriate decontamination and disinfection procedures and (b) implementing procedures enabling contaminated waste to be handled and disposed of without risk.

In isolation facilities where there are human patients or animals who are, or are suspected of being infected with group 3 or group 4 biological agents, containment measures shall be selected from those in Annex V of the biological agents Directive (Indications concerning containment measures for work which involves the handling of group 2, 3 and 4 biological agents), in order to minimise the risk of infection.