

Coronavirus Disease 19 (COVID-19): Implications for Clinical Dental Care

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Abstract:

The recent spread of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and its associated Coronavirus disease (COVID-19), has gripped the entire international community and has caused widespread public health concerns. Despite global efforts to contain the disease spread, the outbreak is still on a rise owing to the community spread pattern of this infection. This is a zoonotic infection that, similar to other coronavirus infections, is believed to have been originated in bats and pangolins, and later transmitted to humans. Once in the human body, this Corona virus (SARS-CoV-2) is abundantly present in nasopharyngeal and salivary secretions of affected patients and its spread is predominantly thought to be respiratory droplet/contact in nature. Dental professionals, including endodontists, may soon encounter patients with suspected or confirmed SARS-CoV-2 infection and will have to act diligently not only to provide care but at the same time prevent nosocomial spread of infection. Thus, the aim of this article is to provide a brief overview of the epidemiology, symptoms and routes of transmission of this novel infection. In addition, specific recommendations for dental practice are suggested for patient screening, infection control strategies and patient management protocol.

Clinical Relevance:

Dental care providers need to be aware and prepared for tackling any impending infectious disease challenge as might be the case in the current outbreak of SARS-CoV-2 transmission and its associated Coronavirus disease (COVID-19) that can be life-threatening to susceptible patients.

Keywords:

coronavirus, COVID-19, SARS-CoV-2, virus, nosocomial, disease transmission, infection, dentistry, endodontics

Introduction:

The outbreak of coronavirus disease 2019 (COVID-19) in the area of Wuhan, China has evolved rapidly into a public health crisis (1) and has spread exponentially to other parts of the world (Fig 1). The novel coronavirus belongs to a family of single-stranded RNA viruses known as *Coronaviridae* (2). This family of viruses are known to be zoonotic or transmitted from animals to humans. These include severe acute respiratory syndrome coronavirus (SARS-CoV), first identified in 2002 and the Middle East respiratory syndrome coronavirus (MERS-CoV), first identified in 2012 (3). There is strong evidence that this novel coronavirus has similarity to coronavirus species found in bats and potentially pangolins, confirming the zoonotic nature of this new cross-species viral-mediated disease (4,5). Since the published genome sequence for this novel coronavirus has a close resemblance with other β -Coronaviruses such as SARS-CoV and MERS-CoV, the Coronavirus Study Group of the International Committee on Taxonomy of Viruses has given its scientific name as SARS-CoV-2, even though it is popularly called COVID-19 virus (6,7). On January 30, 2020, the World Health Organization (WHO) declared the rampant spread of SARS-CoV-2 and its associated disease (COVID-19) a public health emergency with a currently known overall mortality rate to be as high as 3.4% (8,9). According to WHO situation report (March 16, 2020) update on COVID-19, there have been more than 160,000 reported cases and 6,000 deaths worldwide (10) and this number continues to increase (Fig 1). Therefore, measures for prevention, identification and management must be in place for appropriate mitigation of further spread.

Given the widespread transmission of SARS-CoV-2 and reports of its spread to Health Care Providers (HCPs) (3,11), dental professionals are at high risk for nosocomial infection and can become potential carriers of the disease. Such risks can be attributed to the unique nature of dental interventions, which include aerosol generation, handling of sharps and proximity of the provider to the patient's oropharyngeal region. In addition, if adequate precautions are not taken, the dental office can potentially expose patients to cross-contamination. As the understanding of

this novel disease is evolving, dental practices should be better prepared to identify a possible COVID-19 infection, and refer patients with suspected, confirmed, or a history of COVID-19 infection to appropriate treatment centers. Here, we summarize current recommendations for diagnosing and managing patients with COVID-19. While this information is current up to March 2020, we anticipate that new information will emerge and have provided URLs to several useful websites (Fig 2).

Symptoms:

Patients with COVID-19 usually present with clinical symptoms of fever, cough and myalgia. In addition, abnormal chest X-Ray and computer tomography (CT) findings such as ground-glass opacities are typically found in the chest (12). Notably, 80% of these patients have only mild symptoms that resemble flu-like symptoms and seasonal allergies, which might lead to an increased number of undiagnosed cases (13). Although SARS-CoV-2 is known to be highly transmissible when patients are most symptomatic, it is noteworthy that the incubation period can range from 0-24 days, therefore transmission can occur before any symptoms are apparent (12,14). Severe forms of this disease have a predilection for males with a mean age of 56 years with pre-existing chronic illnesses such as cardiovascular disease or immunosuppression. The higher risk patient population manifests symptoms typical of pneumonia or acute respiratory distress syndrome (12).

Routes of transmission:

SARS-CoV-2 infections typically spread through respiratory droplets or by contact (1). Therefore, coughing or sneezing by an infected person can render SARS-CoV-2 airborne, potentially infecting individuals in close contact (radius of approximately 6 feet). This had led to recommendations of social distancing. Another important route of transmission is if droplets of SARS-CoV-2 land on inanimate objects located nearby an infected individual and are subsequently touched by other individuals (1). Indeed, a recent report suggests that the virus remains viable for up to 9 days when it is on a hard surface such as plastic or metal. Thus,

disinfection of objects and hand washing is essential for halting the spread of this disease. This recommendation is strengthened considering that people touch their face on an average 23 times per hour, with 44% of these occurrences involving the mucous membranes of mouth and/or nose (15). In addition, studies have shown the presence of SARS-CoV-2 in both saliva and feces of the affected patients (16,17). It is known that SARS-CoV-2 can bind to human angiotensin converting enzyme 2 (ACE-2) positive cells, which are highly concentrated in salivary glands; this may be a possible explanation for the presence of SARS-CoV-2 in secretory saliva (18,19). Therefore, there is a potential for transmission of COVID-19 via aerosol, fomites or fecal-oral route that may contribute to nosocomial spread in the dental office setting (20).

Patient management and prevention of nosocomial infection:

Based on the experience gained from the previous outbreak of SARS-CoV and data available on SARS-CoV-2 and its associated disease (COVID-19), certain specific measures are discussed here for dental patient management in this epidemic period of COVID-19 (Summarized in Fig 3). On March 16, 2020, the American Dental Association recommended that dentists postpone elective procedures for the next three weeks and instead only provide treatment for dental emergencies.

- I. **Tele-screening and triaging:** Initial screening via telephone to identify patients with suspected or possible COVID-19 infection can be performed remotely at the time of scheduling appointments (Fig 4). The two most pertinent questions for initial screening should include any travel history to COVID-19 affected areas and the presence of any febrile respiratory illness symptoms such as fever and cough. Importantly, to identify high risk areas, live global tracking of reported cases can be done using the dashboard made accessible by the Center for Systems Science and Engineering (CSSE) at Johns Hopkins University (21). Fig 1 represents a screenshot of interactive tracking of COVID-19.

Positive response to either of the two questions should raise initial concern and elective dental care should be deferred for at least two weeks (Note: As mentioned previously, the

incubation period for SARS-CoV2 is variable and can range from 0-24 days). Patients should be encouraged to be in self quarantine particularly if they have been to areas considered at high risk for infections (22).

- II. **Patient evaluation & cohorting:** Upon patient arrival in dental practice, patients should complete a detailed medical history form, COVID-19 screening questionnaire and assessment of a true emergency questionnaire (Fig 4, 5). Dental professionals should measure the patient's body temperature using a non-contact forehead thermometer or with cameras having infrared thermal sensors (20). Patients who present with fever ($>100.4^{\circ}\text{F} = 38^{\circ}\text{C}$) and/or respiratory disease symptoms, should have elective dental care deferred for at least 2-3 weeks. As per the Centers for Disease Control and Prevention (CDC) guidelines, individuals with suspected COVID-19 infection should be seated in a separate, well-ventilated waiting area at least 6 feet from the unaffected patients seeking care (23). Patients should be requested to wear a surgical mask and follow proper respiratory hygiene, such as covering the mouth and nose with a tissue before coughing and sneezing, and then discarding the tissue (23). After informing the patients to self-quarantine themselves, dentists should instruct the patients to report to their physician to rule out possibility of COVID-19.

Pharmacologic management: In suspected or confirmed cases of COVID-19 infections, patients requiring urgent dental care for conditions such as tooth pain and/or swelling, pharmacological management in the form of antibiotics and/or analgesics is an alternative. This approach may offer symptomatic relief and will provide dental professionals some time to develop a plan to deliver dental care with all appropriate measures in place to prevent the spread of infection. It is important to note that on March 17, 2020, the British Medical Journal recommended the use of acetaminophen for analgesia and not ibuprofen in treating COVID-19 infected patients, as ibuprofen may interfere with immune function (doi: <https://doi.org/10.1136/bmj.m1086>). This

recommendation was endorsed by the World Health Organization (WHO) on March 18, 2020.

III. **Specific dental treatment recommendations:**

Patients with active febrile and respiratory illness will most likely not present to dental practices. Based on the assessment of emergency questionnaire (Fig 5), clinicians can gauge the severity of the dental condition and make an informed decision to either provide or defer dental care. Certain instances such as dentoalveolar trauma or progressive fascial space infection will definitely warrant emergency dental intervention. In the unlikely event of providing dental care to suspected or confirmed cases of COVID-19 infection, dentists should be cognizant of the following recommendations:

- Dentists should follow standard, contact, and airborne precautions including the appropriate use of personal protective equipment (PPE) and hand hygiene practices (23). Fig 6 illustrates current CDC guidelines for putting on and removing PPE.
- Preprocedural mouth rinse: Previous studies have shown that SARS and MERS were highly susceptible to povidone mouth rinse (24). Therefore, preprocedural mouth rinse with 0.2% povidone-iodine might reduce the load of corona viruses in saliva (20,25).
- Use of disposable (single use) devices such as mouth mirror, syringes and blood pressure cuff to prevent cross-contamination.
- Radiographs: Extraoral imaging such as panoramic radiograph or CBCT should be used to avoid the gag reflex or cough that may occur with intraoral imaging. When intraoral imaging is mandated, sensors should be double barriered to prevent perforation and cross-contamination (26).
- Dentists should use a rubber dam to minimize splatter generation (of course, this is the standard of care for non-surgical endodontic treatment). It may be advantageous to place the rubber dam so that it covers the nose.

- The actual procedure should minimize generation of aerosol. For example, ultrasonic instruments may impose a greater risk of generating contaminated aerosols. In addition, dentists should reduce the use of high-speed handpieces and three-way syringes.
- Negative pressure treatment room/Airborne infection isolation rooms (AIIRs): It is worth noting that patients with suspected or confirmed COVID-19 infection should not be treated in a routine dental practice setting. Instead, this subset of patients should only be treated in negative pressure rooms or AIIRs. Therefore, anticipatory knowledge of health care centers with provision for AIIRs would help dentists to provide emergent dental care if the need arises (23).
- Human coronavirus can survive on inanimate surfaces up to 9 days at room temperature, with a greater preference for humid conditions (27). Therefore, clinic staff should make sure to disinfect inanimate surfaces using chemicals recently approved for COVID-19 and maintain a dry environment to curb the spread of SARS-CoV2 (28).

Discussion:

The rampant spread of SARS-CoV-2 worldwide increases the likelihood that dental health care professionals will have to treat this subset of the patient population. Universal precautions are crucial to minimize the spread of this virus and its associated disease. As presented in this review, further precautions are necessary that includes careful prescreening of patients and additional measures if treatment of patients with confirmed COVID-19 is deemed necessary. The latest update (March 16, 2020) by the American Dental Association (ADA) recommends dentists nationwide defer elective dental treatment for the next three weeks and focus on emergency care (29). Endodontists are in a unique situation as they may be called upon for the assessment and management of severe odontogenic pain, swelling and dental alveolar trauma in suspected or known COVID-19 patients. It is worth noting that case presentations can be dynamic, and there is a good chance that dental practices might treat some of patients with asymptomatic COVID-19

infections since the incubation period can range from 0-24 days and most patients only develop mild symptoms (12,14). Thus, every patient should be considered as potentially infected by this virus, and all dental practices need to review their infection control policies, engineering controls and supplies. Health care providers must keep themselves up to date about this evolving disease and provide adequate training to their staff to promote many levels of screening and preventive measures allowing dental care to be provided, while mitigating the spread of this novel infection.

In conclusion, healthcare professionals have the duty to protect the public, and maintain high standards of care and infection control. This new emerging SARS-CoV-2 threat could become a less pathogenic and more common infection in the worldwide population. Indeed, it is predicted to persist in our population as a less virulent infection with milder symptoms, if it follows the same evolutionary pattern of the other coronavirus infections (i.e., SARS-CoV and MERS-CoV). Thus, it is important to make informed clinical decisions, educate the public to prevent panic while promoting the health and well-being of our patients during these challenging times. The prudent practitioner will use this review as a starting point and continue to update themselves with useful online information as this outbreak continues (Fig 2).

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Figure Legends:

Figure 1. A screenshot of an interactive map of the global cases of COVID-19 by the Center for Systems Science and Engineering (CSSE) at Johns Hopkins University (21). This dashboard is continually updated and can be accessed at <https://coronavirus.jhu.edu/map.html>. Site accessed March 16, 2020.

Figure 2. List of online resources for COVID-19

Figure 3. Overview of patient screening for COVID-19 and dental management

Figure 4. COVID-19 screening questionnaire

Figure 5. Questionnaire for assessment of a true dental emergency

Figure 6. CDC recommendations for putting on and removing personal protective equipment for treating COVID-19 patients. From: <https://www.cdc.gov/hai/pdfs/ppe/ppe-sequence.pdf>. Site accessed March 17, 2020.



Total Confirmed

181,584

Confirmed Cases by
Country/Region/Sovereignty

81,042 China
27,980 Italy
14,991 Iran
9,942 Spain
8,236 Korea, South
7,272 Germany
6,650 France
4,661 US
2,200 Switzerland
1,551 United Kingdom
1,414 Netherlands

Country/Region/Sov...

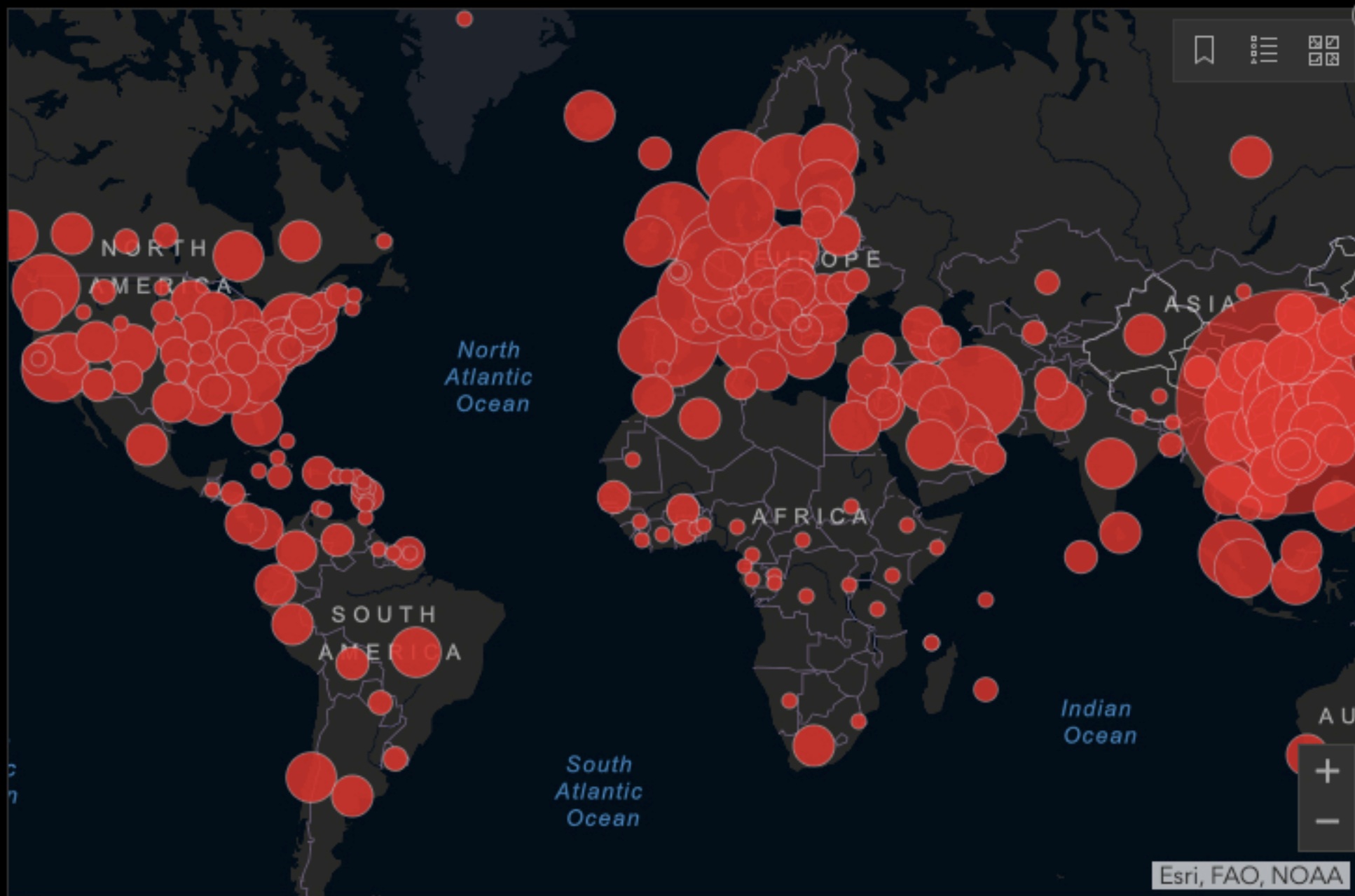
Last Updated at (M/D/YYYY)

3/16/2020, 8:33:03 PM

155

countries/regions

Lancet Inf Dis Article: [Here](#). Mobile Version: [Here](#). Visualization: [JHU CSSE](#). Automation Support: [Esri Living Atlas team](#) and [JHU APL](#).
Data sources: [WHO](#), [CDC](#), [ECDC](#), [NHC](#) and [DXY](#) and local media reports. Read more in this



Total Deaths

7,139

3,111 deaths
Hubei China

2,158 deaths
Italy

853 deaths
Iran

342 deaths
Spain

148 deaths
France France

75 deaths
Korea, South

55 deaths

Total Recovered

78,956

55,987 recovered
Hubei China

4,590 recovered
Iran

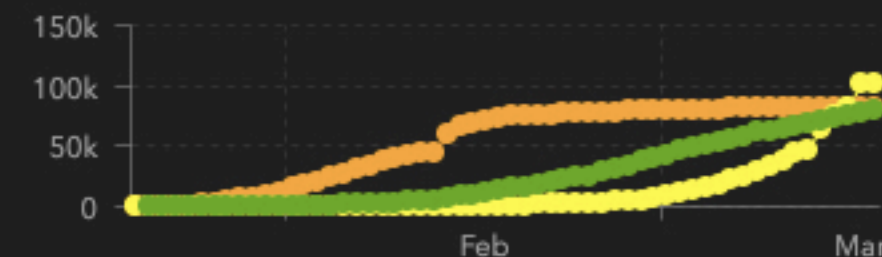
2,749 recovered
Italy

1,306 recovered
Guangdong China

1,250 recovered
Henan China

1,216 recovered
Zhejiang China

1,127 recovered



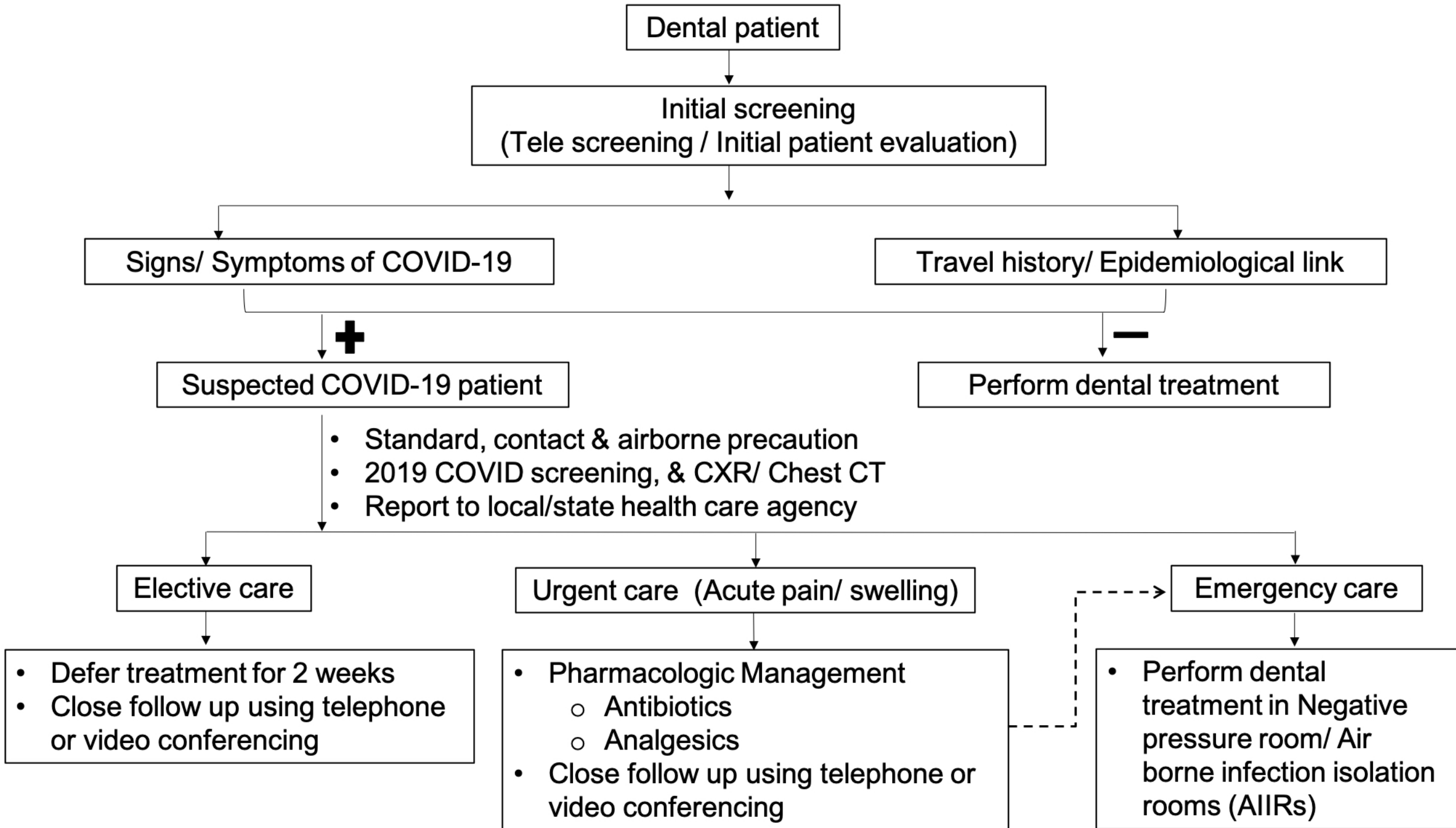
Mainland China
Other Locations
Total Recovered

Actual

Logarithmic

Daily Cases

- Latest updates about Corona virus disease-2019
<https://www.who.int/emergencies/diseases/novel-coronavirus-2019>
- Clinical resource on COVID-19 outbreak
<https://www.nejm.org/coronavirus>
- Routes of transmission of COVID-19
<https://www.cdc.gov/coronavirus/2019-ncov/about/transmission.html>
- Interim infection control recommendations (Includes details on protective equipment, hand hygiene practices and negative pressure rooms)
<https://www.cdc.gov/coronavirus/2019-ncov/infection-control/control-recommendations.html>
- Steps for Healthcare Facilities to prepare for COVID-19
<https://www.cdc.gov/coronavirus/2019-ncov/healthcare-facilities/steps-to-prepare.html>
- Risk Assessment and Public Health Management of Persons with Potential COVID-19 exposure
<https://www.cdc.gov/coronavirus/2019-ncov/php/risk-assessment.html>
- Live-tracking of reported cases
<https://gisanddata.maps.arcgis.com/apps/opsdashboard/index.html#/bda7594740fd40299423467b48e9ecf6>
- Environmental protection agency approved COVID-19 chemical disinfectants
<https://www.epa.gov/pesticide-registration/list-n-disinfectants-use-against-sars-cov-2>



--- Worsening of existing condition

COVID-19 Screening Questions

Date: _____

Name (last name, first name): _____

Date of Birth (mmddyy): _____

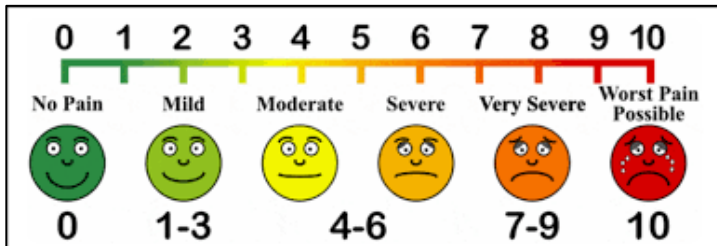
Yes	No	COVID-19 Screening Question
		In the past 14 days, have you or any household member traveled to international area (China, Iran, Italy, Japan, South Korea, and any European country) or anywhere else? If so, please note location:
		In the past 14 days, have you or any household member had any contact with a known COVID-19 patient?
		Have you or any household member have a history of exposure to COVID-19 biologic material?
		Have you had any history of fever in the last 14 days?
		Have you had any respiratory illness such as cough or difficulty breathing in the last 14 days?
		<u>Urgent Dental Need Question</u> Do you have uncontrolled dental or oral pain, infection, swelling or bleeding or trauma to your mouth?

Assessment of a True Emergency
(Circle Patient's Response wherever appropriate)

1) Are you in pain?

Yes or No

2) What is your level of pain on a scale of 0-10?



3) When did the pain begin?

4) Do you have a dental abscess (Are your gums and/or face swollen?)

Yes or No

- When did you first notice the swelling?

5) Do you have a fever?

Yes or No

6) Are you having any trouble swallowing?

Yes or No

7) Are you having any trouble opening your mouth?

Yes or No

8) Did you experience any trauma?

Yes or No

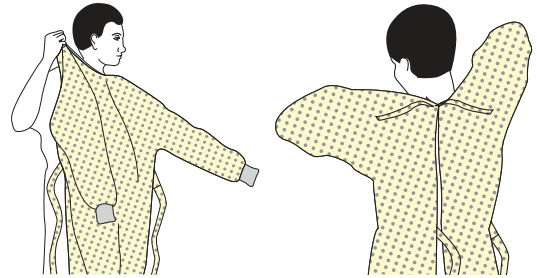
- Please describe the trauma

SEQUENCE FOR **PUTTING ON** PERSONAL PROTECTIVE EQUIPMENT (PPE)

The type of PPE used will vary based on the level of precautions required, such as standard and contact, droplet or airborne infection isolation precautions. The procedure for putting on and removing PPE should be tailored to the specific type of PPE.

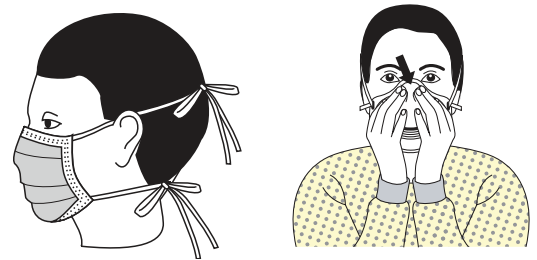
1. GOWN

- Fully cover torso from neck to knees, arms to end of wrists, and wrap around the back
- Fasten in back of neck and waist



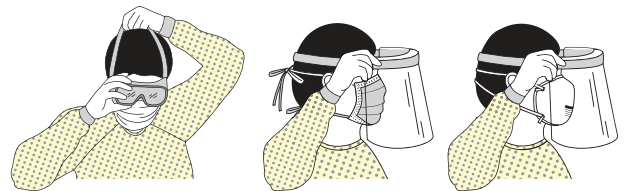
2. MASK OR RESPIRATOR

- Secure ties or elastic bands at middle of head and neck
- Fit flexible band to nose bridge
- Fit snug to face and below chin
- Fit-check respirator



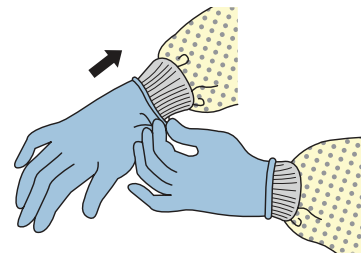
3. GOGGLES OR FACE SHIELD

- Place over face and eyes and adjust to fit



4. GLOVES

- Extend to cover wrist of isolation gown



USE SAFE WORK PRACTICES TO PROTECT YOURSELF AND LIMIT THE SPREAD OF CONTAMINATION

- Keep hands away from face
- Limit surfaces touched
- Change gloves when torn or heavily contaminated
- Perform hand hygiene



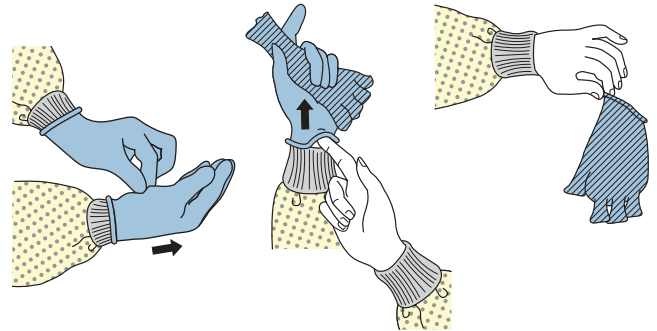
HOW TO SAFELY REMOVE PERSONAL PROTECTIVE EQUIPMENT (PPE)

EXAMPLE 1

There are a variety of ways to safely remove PPE without contaminating your clothing, skin, or mucous membranes with potentially infectious materials. Here is one example. **Remove all PPE before exiting the patient room** except a respirator, if worn. Remove the respirator **after** leaving the patient room and closing the door. Remove PPE in the following sequence:

1. GLOVES

- Outside of gloves are contaminated!
- If your hands get contaminated during glove removal, immediately wash your hands or use an alcohol-based hand sanitizer
- Using a gloved hand, grasp the palm area of the other gloved hand and peel off first glove
- Hold removed glove in gloved hand
- Slide fingers of ungloved hand under remaining glove at wrist and peel off second glove over first glove
- Discard gloves in a waste container



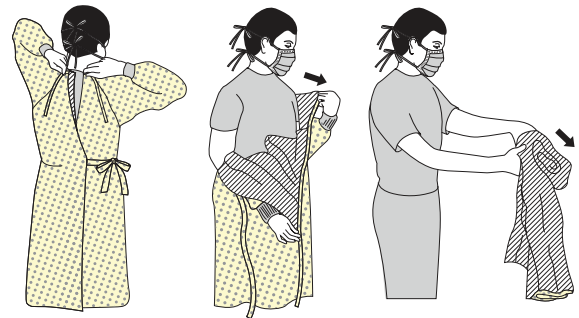
2. GOGGLES OR FACE SHIELD

- Outside of goggles or face shield are contaminated!
- If your hands get contaminated during goggle or face shield removal, immediately wash your hands or use an alcohol-based hand sanitizer
- Remove goggles or face shield from the back by lifting head band or ear pieces
- If the item is reusable, place in designated receptacle for reprocessing. Otherwise, discard in a waste container



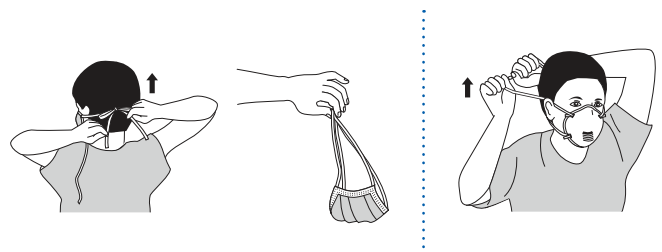
3. GOWN

- Gown front and sleeves are contaminated!
- If your hands get contaminated during gown removal, immediately wash your hands or use an alcohol-based hand sanitizer
- Unfasten gown ties, taking care that sleeves don't contact your body when reaching for ties
- Pull gown away from neck and shoulders, touching inside of gown only
- Turn gown inside out
- Fold or roll into a bundle and discard in a waste container

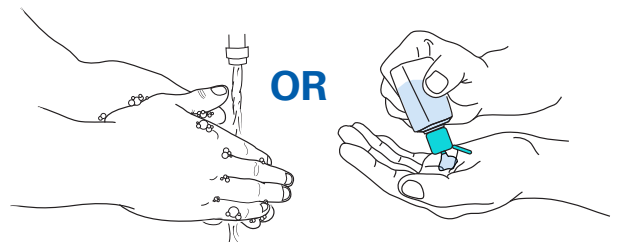


4. MASK OR RESPIRATOR

- Front of mask/respirator is contaminated — DO NOT TOUCH!
- If your hands get contaminated during mask/respirator removal, immediately wash your hands or use an alcohol-based hand sanitizer
- Grasp bottom ties or elastics of the mask/respirator, then the ones at the top, and remove without touching the front
- Discard in a waste container



5. WASH HANDS OR USE AN ALCOHOL-BASED HAND SANITIZER IMMEDIATELY AFTER REMOVING ALL PPE



PERFORM HAND HYGIENE BETWEEN STEPS IF HANDS BECOME CONTAMINATED AND IMMEDIATELY AFTER REMOVING ALL PPE



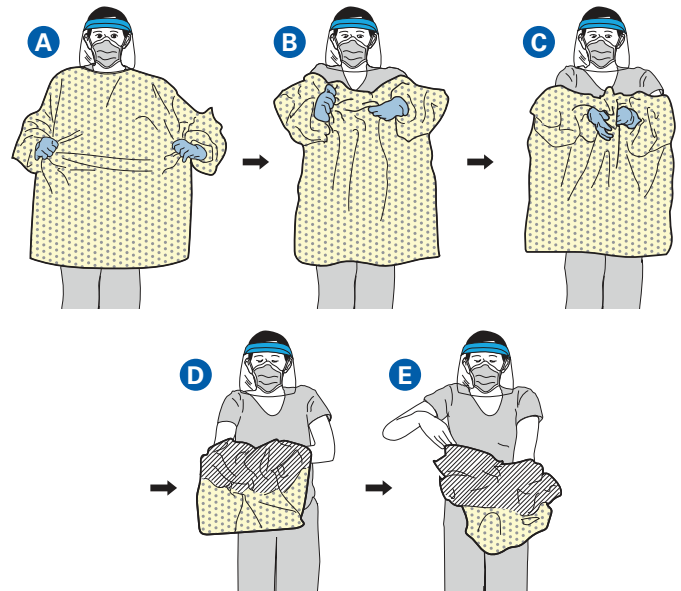
HOW TO SAFELY REMOVE PERSONAL PROTECTIVE EQUIPMENT (PPE)

EXAMPLE 2

Here is another way to safely remove PPE without contaminating your clothing, skin, or mucous membranes with potentially infectious materials. **Remove all PPE before exiting the patient room** except a respirator, if worn. Remove the respirator **after** leaving the patient room and closing the door. Remove PPE in the following sequence:

1. GOWN AND GLOVES

- Gown front and sleeves and the outside of gloves are contaminated!
- If your hands get contaminated during gown or glove removal, immediately wash your hands or use an alcohol-based hand sanitizer
- Grasp the gown in the front and pull away from your body so that the ties break, touching outside of gown only with gloved hands
- While removing the gown, fold or roll the gown inside-out into a bundle
- As you are removing the gown, peel off your gloves at the same time, only touching the inside of the gloves and gown with your bare hands. Place the gown and gloves into a waste container



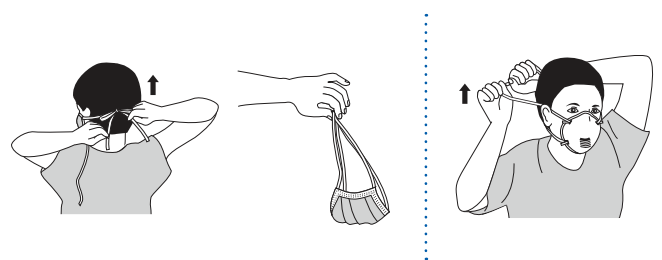
2. GOGGLES OR FACE SHIELD

- Outside of goggles or face shield are contaminated!
- If your hands get contaminated during goggle or face shield removal, immediately wash your hands or use an alcohol-based hand sanitizer
- Remove goggles or face shield from the back by lifting head band and without touching the front of the goggles or face shield
- If the item is reusable, place in designated receptacle for reprocessing. Otherwise, discard in a waste container

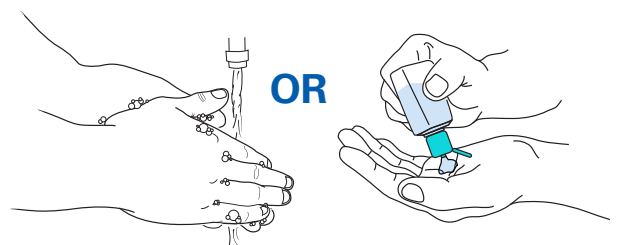


3. MASK OR RESPIRATOR

- Front of mask/respirator is contaminated — **DO NOT TOUCH!**
- If your hands get contaminated during mask/respirator removal, immediately wash your hands or use an alcohol-based hand sanitizer
- Grasp bottom ties or elastics of the mask/respirator, then the ones at the top, and remove without touching the front
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4. WASH HANDS OR USE AN ALCOHOL-BASED HAND SANITIZER IMMEDIATELY AFTER REMOVING ALL PPE



PERFORM HAND HYGIENE BETWEEN STEPS IF HANDS BECOME CONTAMINATED AND IMMEDIATELY AFTER REMOVING ALL PPE

