

Fortifying defenses: Tactical safety protocols for COVID-19 sub-variant JN.1 in healthcare and laboratory settings

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ABSTRACT

Introduction: Primary care physicians are crucial in fighting COVID-19, especially with the emergence of the new JN.1 sub-variant. **Measures to Reduce Risk:** Given your direct exposure to infected patients, it is imperative to establish a protocol for triaging patients with respiratory symptoms and to uphold a minimum distance of 2 meters between patients and primary care physicians. Patients suspected or diagnosed with the JN.1 sub-variant should be advised to wear surgical masks for their protection and others protection. Primary care physicians must also use personal protective equipment (PPE) and maintain strict hand hygiene practices when dealing with these patients. Patient samples should be treated as high risk for contamination, and laboratory procedures should be meticulously evaluated for potential hazards. PPE should be tailored to the procedure. **Conclusion:** To protect the health and well-being of primary care physicians, who play a critical role in addressing the challenges, it is essential to strictly adhere to infection control measures.

Keywords: COVID-19 sub-variant JN.1, personal protection equipment, primary care physicians

Introduction

In primary care and family medicine, understanding the nuances of JN.1 sub-variant of the novel coronavirus (COVID-19) transmission is paramount to effectively safeguarding patients and healthcare providers.^[1] The emergence of the JN.1 sub-variant presents a notable challenge because it has the potential for asymptomatic transmission, allowing individuals to spread the virus without showing symptoms. Consequently, it is crucial to implement rigorous infection control measures to address this

risk. The primary way the virus spreads is through respiratory droplets and close contact. Infected individuals can spread the virus before experiencing symptoms and remain contagious for several days.^[2] In addition, new studies emphasize the potential for aerosol transmission, indicating that the virus can remain viable in the air for prolonged periods, especially after aerosol-generating procedures. These findings underscore the important responsibility of primary care providers and family physicians in carrying out preventive measures, handling cases, and sharing accurate information to reduce the spread of COVID-19 in local areas.^[3]

This article presents an overview of JN.1, a subvariant of COVID-19 that poses unique challenges to healthcare systems. It aims to provide primary care physicians with the knowledge

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and tools to manage patients with suspected or confirmed cases of JN.1 infection. Additionally, the article explores the broader implications of JN.1 on healthcare delivery, including the potential strain on resources and strategies for mitigating the virus's spread within primary care settings.

Historical Background

The lineage designated as JN.1 can be traced back to its predecessor, BA.2.86, and was initially identified on August 25, 2023. Recently, there has been a growing number of reports of JN.1 in multiple countries, signifying its increasing global prevalence. While implementing suitable personal protective equipment (PPE) can effectively reduce the risk of transmission, it does not guarantee complete prevention. The heightened infection rate among primary care physicians is largely attributed to extended work shifts exceeding 10 hours per day, stemming from understaffing and a high volume of patients. Moreover, prolonged fatigue and stress can compromise the immune system, rendering individuals more susceptible to the JN.1 sub-variant of COVID-19. The rapid spread of infection has led to a notable depletion of PPE supplies and an upsurge in infections among healthcare personnel, consequently elevating the transmission rate among visitors, staff, and patients.^[4,5] Ethics committee approved by 2024, No. SDDC/Admin/973/2023.

Measures to Reduce Exposure Risk

To mitigate the potential transmission of COVID-19 sub-variant JN.1 from patients to primary care physicians, it is imperative to exercise necessary precautions throughout the patient admission process. This entails the postponement of elective surgeries and routine check-ups and the implementation of triage protocols for patients presenting with symptoms of acute respiratory infection (ARIS).^[6,7] These protocols should encompass measures such as restricting hospital entry points, providing face masks to all patients, ensuring their continuous utilization, and ensuring that health care personnel (HCP) are suitably equipped with PPE to deliver care. Furthermore, suspected COVID-19 sub-variant JN.1 cases should be promptly and securely isolated to curtail further virus dissemination.^[6]

It is advisable to position hand sanitizing stations at the entry points of healthcare facilities, patient quarters, and waiting areas. The hand sanitizers should contain an alcohol concentration of 60–95%. Additionally, touchless waste receptacles should be made accessible. To reduce close proximity, consider installing a physical partition constructed of glass or plastic between triage staff and potentially contagious patients. During patient assessments, maintain a minimum distance of 2 meters between healthcare providers and patients and ensure that examination spaces are well-ventilated.^[6]

Primary care physicians who have been near or have provided care to a patient infected with the COVID-19 sub-variant JN.1 are at risk of contracting the same sub-variant of COVID-19. As

per the guidelines set forth by the Centers for Disease Control and Prevention, close contact is defined as being near an infected individual within the same physical space without maintaining a minimum distance of 2 meters and having direct exposure to the individual's bodily secretions.^[6] Close contact with someone who has been diagnosed with the COVID-19 sub-variant JN.1 includes being face-to-face with the person within 2 meters for more than 15 minutes. It also includes being in a room where an aerosol-producing procedure is happening without wearing the necessary protective equipment or having any contact with the person's bodily fluids or laboratory samples without using the required protective equipment.^[7,8]

Communicating effectively among healthcare providers (HCPs) is absolutely crucial for controlling the spread of COVID-19 sub-variant JN.1. It's imperative to take necessary measures to minimize the risk of transmission among primary care physicians and between HCPs and patients. Forming teams of providers who work in hospitals and labs is a highly effective way to ensure social distancing and reduce the chances of cross-infection. In addition, all HCPs must undergo twice-daily screening for Acute Respiratory Illness Syndrome (ARIS) symptoms and body temperature to enable early diagnosis. If a primary care physician on the team is infected with COVID-19 sub-variant JN.1, all close contacts should undergo quarantine measures as a precautionary step.^[9]

The following is information regarding measures for isolation to prevent transmission of COVID-19 sub-variant JN.1: Primary care physicians must proactively implement protective measures, assuming that any individual they contact could be infected or colonized with a pathogen capable of spreading in a healthcare environment. To effectively curb the transmission of COVID-19 sub-variants, primary care physicians must implement enhanced precautions during aerosol-generating procedures (AGPs) on top of the standard measures for droplet, close contact, and airborne transmission.^[10] Hand hygiene is a primary measure that should be ensured to reduce transmission in healthcare facilities.^[11]

Hand hygiene

Primary care physicians must adhere to strict hand hygiene protocols when interacting with patients or potentially contaminated materials, as well as before and after using PPE. To minimize the risk of contamination, it is imperative for physicians to thoroughly wash their hands with soap and water for at least 20 seconds or disinfect them with a 60–95% alcohol-based hand disinfectant. Additionally, ensuring hand hygiene before and after entering intensive care units (ICUs) is essential to prevent the spread of infections. Healthcare workers must follow these rules carefully to keep patients and staff safe.^[11]

Personal protective equipment

The transmission of COVID-19 sub-variant JN.1 in healthcare settings can be attributed to the ineffectiveness of PPE.^[12] To ensure the safe use of PPE, healthcare institutions should establish clear procedures and policies. Following proper hand

hygiene, the recommended sequence for donning PPE is the gown, mask, goggles, face shield, and gloves. The order for doffing PPE is gloves, face shield, goggles, gown, and mask. It is imperative to keep the mask on until the primary care physician has exited the contaminated area and properly removed it. Last, thorough hand hygiene should be observed after removing all PPE items.^[11] According to these procedures, the World Health Organization (WHO) has defined the appropriate PPE for HCPs 10. Table 1^[13–16] gives recommendations about using PPE.

Masks

According to the European Centre for Diseases and Prevention Control (ECDC), if there is a shortage of FFP2/FFP3 masks and a health care personnel (HCP) needs to come in contact with a diagnosed or suspected COVID-19 sub-variant JN.1 case where there is no risk of aerosol transmission, they can use surgical masks along with eye protection, gown, and gloves. However, if the primary care physicians perform procedures that generate an aerosol, such as sample collection, they should use FFP2/FFP3 masks for high-level protection.^[7] The mask used for sample collection can contact multiple patients for a maximum of 4–6 hours unless it has been damaged, moistened, and/or soiled or is not indicated by the manufacturer.^[7]

In the COVID-19 sub-variant JN.1 handbook developed by Chinese experts, it says that primary care physicians in healthcare

facilities should wear medical masks. For extra protection, it recommends that primary care physicians in special areas like the emergency department, respiratory care outpatient department, infectious diseases outpatient department, stomatology department, or endoscopic examination room should use a medical protective mask, such as an N95 mask.^[17] When wearing a mask, it is essential to ensure that it is carefully placed on the face and that there is no gap between the mask and the face.^[13] This is because facial hair, such as a beard, can prevent the mask from adequately sitting on the face, reducing its protective effect.^[10,11]

Eye protection

COVID-19 sub-variant JN.1 transmission through the eyes is not confirmed yet. However, animal experiments have shown that this type of transmission is possible. Primary care physicians should wear eye protection when entering a patient's room. Please note that regular eyeglasses or contact lenses do not provide enough protection against potential transmission.^[17] Removing the eye protection equipment upon exiting the designated patient room or care area is crucial. Reusable eye protectors must be thoroughly cleaned and disinfected according to the manufacturer's guidelines before being used again.^[6]

Gloves

Primary care physicians must wear clean, non-sterile gloves before entering patient rooms or care areas. If the gloves become

Table 1: Please find below the recommended type of personal protective equipment (PPE) to be used in the context of COVID-19 sub-variant JN.1 disease

Setting	Target staff	Activity	Type of PPE
COVID-19 patient room in clinics	Healthcare workers	Providing direct care	Surgical mask Gloves Gown Goggles/face shield
	Cleaners	Aerosol-generating procedures performed on COVID-19 sub-variant JN.1 patients Entering the room of COVID-19 sub-variant JN.1 patients	FFP2 mask Goggles Long-sleeved water-resistant gown Goggles and face shield FFP2 mask Gloves Gown Goggles or face shield Boots or closed work shoes
Ambulance or transfer vehicle COVID-19 sub-variant JN.1 patient	Healthcare workers	Transporting suspected COVID-19 sub-variant JN.1 patients	FFP2 mask Double nonsterile gloves Long-sleeved water-resistant gown Goggles or face shield
Outpatient facilities	Healthcare workers	Patient with respiratory symptom	Surgical mask Gloves Gown Goggles
	Cleaners	After and between consultations of patients with respiratory symptoms	Surgical mask Gloves Gown Boots or closed work shoes
Waiting room	Patient		People with respiratory symptoms should wear a medical mask. Isolate them if possible, or keep a 1 m distance from others.
Laboratory	Laboratory personnel	Working with respiratory samples	FFP2 mask Double nonsterile gloves Long-sleeved water-resistant gown Goggles or face shield

damaged or contaminated, the primary care physician must practice hand hygiene and replace them with new ones. The gloves must be removed upon exiting the care areas, and hand hygiene protocols must be observed. It is imperative to note that gloves should not be washed and reused.^[18]

Disposable aprons and gowns

Primary care physicians must don a clean isolation gown before entering patients' rooms or care areas. If the gown becomes contaminated, it must be promptly changed and disposed of in a red waste container before leaving the area. Reusable gowns should undergo thorough washing after each use to mitigate the transmission of pathogens. In gown shortages, procedures with a high risk of contamination, such as AGPs, should be prioritized. These procedures can expose primary care physicians' clothing and hands to pathogens due to spatters and increased risk of contamination.^[6] The UK's patient care guidance recommends using single-use plastic aprons to shield against contamination. In addition, long-sleeved, disposable fluid-repellent gowns are necessary during AGPs.^[19]

Amidst the pandemic, the unavailability of PPE has become a pressing concern. It is recommended that primary care physicians avoid touching their masks and eye protectors. These should be replaced if damaged, contaminated, or when leaving a COVID-19 unit.^[6] Primary care physicians are advised not to unnecessarily handle eye protectors and masks. These protective equipment should be replaced if damaged or contaminated or when the primary care physician leaves the unit.^[6]

The medical equipment allocated for patient use must be dedicated to individual patients and should not be shared or transferred between patients. Equipment such as stethoscopes and thermometers, which multiple patients use, should be thoroughly disinfected and cleaned after each use using a 70% ethyl alcohol solution. It is important to have two medical waste containers, one inside and one outside patient rooms, available to dispose of used PPE.^[17]

Aerosol-Generating Procedures

It is important to note that certain medical procedures are considered AGPs due to their production of small particles that can potentially facilitate the spread of respiratory infections, such as COVID-19 sub-variant JN.1. These procedures encompass intubation, extubation, open suctioning of the respiratory tract, tracheotomy/tracheostomy procedures, bronchoscopy, specific surgeries, postmortem procedures involving high-speed devices, noninvasive ventilation (e.g. BiPAP and CPAP), induction of sputum, high-flow nasal oxygen (HFNO), high-frequency oscillating ventilation (HFOV), and cardiopulmonary resuscitation.^[19,20] Some dental procedures, such as high-speed drilling, can even be considered AGPs. It is important to note that collecting diagnostic respiratory specimens for COVID-19 sub-variant JN.1 is also considered an AGP as it can induce a coughing reflex and generate aerosols.^[7]

Precautions for aerosol-generating procedures

For primary care physicians performing AGPs on suspected or confirmed COVID-19 sub-variant JN.1 cases, it is recommended to use a long-sleeved disposable fluid-repellent gown that covers the arms and body, a higher level of respiratory protection such as N95/FFP3 masks, a full-face shield or visor, and gloves. This combination of PPE provides an adequate barrier against the spread of respiratory droplets and aerosols that can potentially transmit the virus.^[6,19] Before conducting any procedures, performing a fit test per the guidelines^[21,22] is crucial. Access to the designated area should be restricted to essential personnel only. The procedures should also involve only personnel necessary for the task at hand. These procedures must be carried out in respiratory tract isolation rooms, and the surfaces of these rooms should be thoroughly cleaned. Additionally, the rooms must be disinfected after every procedure to ensure safety and prevent any potential spread of infections.^[6]

After using AGPs, the surrounding environment can become heavily contaminated with aerosols. The duration for the aerosols to be appropriately cleaned is dependent on the presence of either mechanical or natural ventilation. The cleaning time required for the aerosols to reach a sufficient level (where healthcare personnel can enter the room without needing FFP3 masks) relies on the air change per hour (ACH) in the room. General wards and single rooms are recommended to have a minimum of 6 ACH, while negative pressure isolation rooms should have a minimum of 12 ACH. The higher the ACH, the faster the aerosol cleaning process will be. It is believed that the first air change can reduce the contaminants by 63%, and after 5 air changes, less than 1% of the contaminants will remain in the air.^[14] In the case of negative pressure isolation rooms, it is advisable to allow for a 20-minute vacancy period after a patient is discharged or transferred before initiating the cleaning process. On the other hand, for neutral pressure rooms, it is recommended to open the windows and let the room stay that way for an hour before cleaning.^[14]

According to the advisory group for new and emerging respiratory virus threats, the aerosol generated during nebulization is produced by the fluid in the nebulizer rather than the patient's viral particles. As per the United Kingdom's guidelines, administering pressurized humidified oxygen or medication via nebulization is not considered a significant risk for aerosol generation.^[19] However, both WHO and Centers for Disease Control (CDC) consider nebulizer therapy an aerosol-generating procedure. As per the guidelines of the United Kingdom, pressurized and humidified oxygen or nebulized medication is not considered a significant source of infection via aerosol generation. However, the WHO and CDC classify nebulizer therapy as an aerosol-generating procedure.^[15,23]

Recommendations for Environmental Cleaning

Nosocomial virus transmission is caused by patients who carry a high virus load and contaminate their environment. This leads to

significant environmental contamination, increasing the risk of transmission to other patients and healthcare workers. Therefore, effective infection control measures are necessary to prevent the spread of the virus within a healthcare setting.^[24] Recent reports suggest that using a combination of water and detergent to clean environmental surfaces and patient care equipment, followed by applying appropriate disinfectants, can effectively maintain hygiene and prevent the spread of infections in healthcare settings. These findings indicate that standard hospital-level disinfection protocols can sufficiently control the transmission of harmful pathogens.^[25] The COVID-19 sub-variant JN.1 exhibits sensitivity to a range of disinfectants, including 0.1% to 0.5% sodium hypochlorite, 70% ethyl alcohol, 1% povidone-iodine, 0.24% chloroxylonol, 50% isopropanol, 0.05% benzalkonium chloride, 1% cresol soap, and 0.5% to 7.0% hydrogen peroxide.^[26] In COVID-19 sub-variant JN.1 isolation areas, it is advisable to disinfect all surfaces, including typical flooring, walls, and objects, using a solution that contains 1000 mg/L of chlorine. For maximum safety, it is recommended to repeat the disinfection process three times whenever contamination is identified.^[17] The health care personnel (HCP) in charge of cleaning the surroundings and disposing of waste should wear PPE appropriate for the task at hand.^[7]

COVID-19 Laboratory Biosafety

It is advised that all laboratory samples should be treated as potentially infectious. However, testing unidentified COVID-19 sub-variant JN.1 samples may increase the risk of transmission for laboratory workers.^[9,27] Ensuring that all personnel receive comprehensive education regarding handling biological agents and the associated potential hazards is imperative. Before conducting any tests, laboratories must perform a thorough risk assessment to identify potential hazards. To the identified risks, laboratory personnel should carefully select and utilize appropriate PPE. This equipment should encompass a gown, gloves, eye protection, a shield, and a mask, with the selection based on the potential risk posed by the procedure.^[28] While laboratory processes have become increasingly automated, manual touch points within the system can elevate the risk of transmission and contamination. It is imperative to communicate these risks to all personnel working in the laboratory. Moreover, implementing specific procedures to minimize the generation of aerosols and droplets during analyses is essential. These procedures must be established with meticulous attention to detail. To diminish the risk of sample contamination during transportation, it is advised to refrain from using pneumatic tubing. Furthermore, informing the laboratory well before dispatching samples^[29,30] is crucial. When the medical staff takes blood samples, including serological tests, they must follow specific Good Microbiological Practices and Procedures (GMPP) procedures to ensure safety and accuracy.^[28]

To ensure laboratory biosafety for COVID-19, WHO has specific guidelines that must be followed. These guidelines require personnel performing procedures to conduct a thorough risk

assessment and follow necessary protocols. Before deactivating any samples, the first step should be to perform the procedure in an approved biosafety cabin (BSC) or a primary containment device. Samples from suspected or diagnosed COVID-19 sub-variant JN.1 patients should be carried as “Biological Substance Category B” UN3373, while viral cultures and isolates should be taken as Category A UN2814, which is “infectious substance, affecting human”. Diagnostic procedures like sequencing or NAAT that do not pose the risk of transmission should be performed in bio-safety level 2 (BSL-2) labs. However, methods like virus culture, isolation of the virus or neutralization experiments that carry the risk of transmission should only be performed in BSL-3 labs with air inflow. To ensure effective disinfection against COVID-19, it is essential to use suitable disinfectants with proven efficacy.^[28]

Various compounds have proven effective to effectively disinfect laboratory surfaces against COVID-19 sub-variant JN.1. For viruses with a viral envelope and blood spills, sodium hypochlorite at a concentration of 1000 ppm (0.1%) and 10,000 ppm (1%), respectively, have shown effectiveness. Additionally, 62–71% ethanol, 0.5% hydrogen peroxide, quaternary ammonium, and phenolic compounds have also been effective. It is important to note that the type of disinfectant used, the contact duration, the concentration of the active compound, and the expiration date after solution preparation should be carefully considered.^[28] The necessity of biosafety measures may induce stress on the laboratory personnel. However, it is possible to reduce the risk of transmission and develop a safe working environment in the laboratory by implementing these measures.^[9]

Healthcare providers (HCPs) encounter many challenges that can significantly impact their physical and psychological well-being. These challenges encompass prolonged working hours, heightened stress levels associated with triage decision-making, and the emotional strain of experiencing the loss of patients and colleagues. Furthermore, primary care physicians face an elevated risk of contracting infections, compounding their demanding working environment. It is imperative to acknowledge that HCPs play a crucial role in public health and must be comprehensively supported to ensure their ongoing ability to deliver optimal patient care.^[31] The containment of the pandemic relies significantly on the well-being and efficiency of health care personnel (HCP) teams. Considering the virus's rapid spread, it is imperative to implement urgent measures to safeguard primary care physicians. These include prioritizing their safety, guiding the appropriate use of PPE, enhancing logistical support and medical equipment provisions, and implementing advanced disinfection techniques in hotels where HCPs will be accommodated during the pandemic.^[4]

Abbreviation

- HCP – Health Care Personnel
- PPE – Personal Protective Equipment.
- BSL-2 – Bio-Safety Level 2

- BSC – Biosafety Cabin
- GMPP – Good Microbiological Practices and Procedures
- WHO – World Health Organization
- CDC – Centers for Disease Control
- ACH – Air Change Per Hour
- AGP – Aerosol-Generating Procedure
- ECDC – European Centre for Diseases and Prevention Control
- HFNO – High-Flow Nasal Oxygen
- HFOV – High-Frequency Oscillating Ventilation
- ARIS – Acute Respiratory Infection Symptoms.

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Conflicts of interest

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