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Information and General Guidance for Healthcare Professionals in the Fourth Wave of COVID-19

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The COVID-19 curve seesawed and reached the fourth pandemic in July 2021. Since the first three waves, the focus has been on achieving herd immunity through vaccination while a lot of manpower is used for quarantine. However, we have not been able to prevent the fourth wave. The causes are thought to be related to people who doubt the safety of the vaccine and refuse it or violate quarantine guidelines such as social distancing. This study examined guidelines for preventing and controlling COVID-19, the accuracy of vaccination-related information, and described quarantine measures including for those who completed vaccination. In conclusion, prevention and vaccination are the most effective countermeasures against COVID-19. We recommend people vaccination with self-quarantine. Also, it is necessary to make large investments to protect and support nurses in future pandemics.

Key words: COVID-19; Guideline; Health Personnel; Vaccines

INTRODUCTION

Severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) is included in the *Coronaviridae* family, *Betacoronavirus* genus, *Sarbecovirus* subgenus, and 30 kb enveloped, non-segmented, (+) ssRNA. Each virus particle is 0.05 to 0.2 μm in diameter [1]. As the SARS-CoV-2 (COVID-19) continues to spread and evolve, World Health Organization (WHO) and partners are characterizing emerging variants of concern (VOCs) to evaluate increased transmissibility and other potential phenotypic impacts [2]. A total of 11 global rapid risk assessments have been undertaken for COVID-19, and additional assessments were conducted for specific events around the emergence of SARS-CoV-2 VOCs, alpha, beta, gamma, and delta [2]. Analysis of infection pattern of recent fourth wave (July 4~10, 2021) showed increased mutation (36.9%) and infection among acquaintances and colleagues of the same age group in Korea [3]. Although there is an interval of several months, the fourth wave appears in a similar pattern. According to WHO, the global number of new cases during July 5 to 11, 2021 was nearly three million, a 10% increase as compared to the previous week and with almost 56,000 new deaths in the past week; cumulative deaths have now surpassed four million [2].

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Each country updated the COVID-19 response guidelines based on the Centers for Disease Control and Prevention (CDC) or WHO. The Korean government also released the 10th edition on May 17, 2021, reported the situation daily, and quarantine guidelines for the general public were emphasized [4]. Healthcare professionals who contact or care for COVID-19 patients work in a medical environment that is likely to be directly or indirectly exposed to patients or infectious substances. Medical personnel's failure to follow infection source guidelines increases the likelihood that they will become sources or mediators of the spread of COVID-19. Thus, mitigating and reducing these infection risks is essential to protecting their well-being and reducing the spread [5]. Therefore, it is necessary to focus on the role of nurses in the prevention and management of COVID-19 during this fourth wave.

Next, to end this pandemic, the world needs to achieve herd immunity and the safest way is through vaccines. Humans have relied on vaccines to reduce the death toll of infectious diseases. In total, 26.6% (3.73 billion) of the world population has received at least one dose of a COVID-19 vaccine, and 30.84 million vaccines are now administered each day globally. However, only 1.1% of people in low-income countries have received at least one dose [6]. The evidence on the efficacy and effectiveness of COVID-19 vaccines against emerging variants is limited; however, full vaccination offers high levels of protection against severe disease and death for all four VOCs [2]. Healthcare professionals are required to know the contraindications and possible side effects of each vaccine [6]. Misinformation about the types and side effects of the COVID-19 vaccine leads to the vaccination refusal.

Finally, the scientific basis for excluding vaccinated people from wearing masks and practicing social distancing is not clear yet. Therefore, it is necessary to provide accurate information with data from reputable institutions regarding post-vaccination quarantine guidelines. When coronavirus infections of Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS) occurred, there was a lack of proper guidelines for nurses to respond to the general and special populations in Korea. However, now there are healthcare professionals who can manage the impacts of acute changes, especially for people at the highest risk from COVID-19.

Therefore, this review paper aimed to show the nursing practice guidelines for prevention and management of COVID-19, vaccination, and guidance for fully vaccinated people. For this, we composed general precautions targeted not only people residing in a community but all patients and health workers using reliable data and public documents.

PREVENTION AND MANAGEMENT STRATEGIES INCLUDING GENERAL PRECAUTIONS

Clinical nurses should be aware of the following management strategies in hospitals and other medical institutions, along with the general prevention and management strategies about COVID-19 prevention. Among the infection prevention and control (IPC) strategies required by medical institutions to prevent COVID-19 transmission are as follows

1. Screening and triage: for early detection of suspected COVID-19 patients

Screening means rapid identification of signs and symptoms of COVID-19, and triage refers to prioritizing attention by severity using valid tools (e.g., WHO/ICRC/MSF/IFRC Integrated Interagency Triage Tool; https://apps.who.int/iris/bitstream/handle/10665/331492/WHO-2019-nCoV-HCF_operations-2020.1-eng.pdf, https://www.who.int/health-topics/emergency-care#tab=tab_1). It is important to screen at the first point of contact with a healthcare facility, recognize suspected COVID-19 patients early, and quarantine/separate immediately. Staff training on signs and symptoms and the most recent case definition and alertness to potential infections are important for the early identification of suspected cases [7].

It is necessary to ensure that those (e.g., healthcare personnel, patients, visitors) entering a healthcare facility with COVID-19 symptoms or suspicions are managed in an appropriate manner [8]. Although it is not always possible to identify symptoms through contact with a confirmed person,

symptoms of COVID-19 include fever, chills, coughing, breathing difficulties, fatigue, muscles or body aches, as already known, and headaches, taste or odor loss, sore throat, congestion or runny nose, nausea or vomiting, and diarrhea [9]. To address these and pre-symptomatic transmission problems, it is essential to ensure that everyone wears a face mask regardless of symptoms. This helps prevent transmission from infected people regardless of COVID-19 symptoms [10].

2. Applying standard precautions for all patients and the environment

According to the literature, COVID-19 is transmitted among people mainly through water droplets that are generated when breathing and aerosols in a small range [11]. Droplet permeation occurs from close contact with people with respiratory symptoms such as coughing or sneezing, which causes mucus from the mouth, nose, or eye conjunctiva to be potentially exposed to infected respiratory droplets. Transmissive SARS-CoV-1 particles (P9 variants) have been found to survive for up to 4~5 days on metal, paper, wood, and plastic surfaces [11]. Hence, precautions are needed for direct contact and smear blockage, including the use of personal protective equipment (PPE) such as medical masks, gloves, goggles for eye protection, or facial protection devices [7]. Additionally, transmission can be caused by direct or indirect contact with an immediate environment or object used by infected people (e.g., stethoscope or thermometers) [12].

Regarding environmental management, cleaning and disinfection is part of the care management by nurses, and it is important to observe these procedures consistently and properly. Cleaning is an essential first step in the disinfection process. Use of cleaning detergent (commercially prepared) or soap and water should proceed from the clean to the dirtiest areas, and higher to lower levels. The chlorine-based disinfectant against COVID-19 should be used [7]. Dedicated medical equipment should be used for patients suspected or identified with COVID-19. Non-dedicated, non-disposable medical equipment must be cleaned and disinfected in accordance with instructions from the manufacturer and facility policies [8].

The COVID-19 transmission occurs mostly through droplets and aerosols of respiratory secretions during coughing or sneezing, which can reach other people's noses, mouths, or eyes. Aerosols and droplets are secreted at different rates depending on the type of activity, such as speaking, coughing, and sneezing. Direct contact with fomites carrying COVID-19 and respiratory or eye mucous membranes are associated with viral transmission. Transmissive SARS-CoV-1 particles (P9 variants) have been found to survive for up to 4~5 days on metal, paper, wood, and plastic surfaces [11]. Hence, precautions are needed for direct contact and smear blockage, including the use of PPEs such as medical masks, gloves, goggles for eye protection, or facial protection devices [7].

In the case of COVID-19 transmission, many respiratory droplets evaporate to produce fine aerosols (< 5 μm) and normal breathing and respiratory aerosols [11]. The current WHO list of aerosol-generating procedures related to the nursing work environment is noninvasive artificial ventilation, tracheal intubation and tracheotomy, bronchoscopy, and cardiopulmonary resuscitation (CPR) and so on. Contact and airborne precautions will be followed when nurses take care of patients who are developing aerosols and are suspected of being infected with COVID-19 or have been confirmed to be infected. N95 masks and filtering face-piece (FFP3) respiratory or equivalent masks should be used. There is also a need for a program to regularly test staff for proper use of N95 respiratory shields [7].

3. Implementing administrative controls

To minimize transmission among patients or to healthcare workers, the outline of the nurse staffing protocol should be prepared. A constant physical distance (at least six feet) is an important strategy for preventing COVID-19 transmission. The number of patients in the waiting room should be limited, or the seating arrangement should be adjusted to ensure that they can sit at least six feet apart [8]. All healthcare facilities in areas where there is COVID-19 community transmission should implement policies that restrict access to visitors. From the first wave of COVID-19 to the

present, most national policies and guidelines have recommended avoiding or limiting visitors. For this, strict regulation is required to block visitors and ensure minimal visitors [7]. Restricting or prohibiting facility visitors is an essential environmental management factor for the physical and emotional well-being of managed patients [8].

COVID-19 VACCINATION: INFORMATION FOR HEALTHCARE WORKERS

Vaccines are highly effective methods for controlling and eliminating vaccine-preventable diseases. They are one of the most cost-effective public health investments among the target groups [13]. Significant effort has been made to develop vaccine candidates using various approaches that encompass traditional live attenuated and inactivated vaccines and modern solutions using viral vectors, mRNA, DNA, single proteins, and virus-like particles as carriers [14,15]. In 2020, new vaccine platforms—including mRNA vaccines and viral vector-based DNA vaccines—have been given emergency use authorization (EUA), leading to mass vaccinations worldwide.

As of March 23, 2021, the following four vaccines are listed for emergency use and approved by WHO: BNT162b2 (Pfizer-BioNTech; Pfizer Inc., New York, NY, USA; BioNTech, Mainz, Germany), mRNA-1273 (Moderna; Moderna, Cambridge, MA, USA), Ad26.COV2.S (Janssen; Johnson & Johnson, New Brunswick, NJ, USA), and AZD1222 (AstraZeneca; AstraZeneca, Cambridge, UK). These vaccines were evaluated for their immunogenicity and safety through phase 1/2 clinical studies. In the phase 3 clinical study, vaccine efficacy and adverse events were confirmed by comparing the vaccine and the control group. The efficacy of Pfizer-BioNTech, Moderna, Janssen, and AstraZeneca are 95% (95% credible interval [CI], 90.3%~97.6%), 94.1% (95% CI, 89.3%~96.8%), 66.9% (95% CI, 59.1%~73.4%), and 70.4% (95% CI, 54.8%~80.6%), respectively [16].

In late 2020, reports from the United Kingdom, Brazil, South Africa, and India confirmed the emergence of SARS-CoV-2 variants: B.1.1.7 (or alpha), AY.2 (or delta), P.1 (or gamma), B.1.351 (or beta), and B.1.617.2 AY.1 and AY.2 (or delta), respectively [17]. Regarding delta variant, in the UK, although data showed there was a higher risk of hospitalization compared with the alpha variant, two doses of vaccination were found to provide a high degree of protection, estimated at over 90% [18]. NVX-CoV2373 (Novavax, Gaithersburg, MD, USA) vaccine, which is scheduled to be introduced in Korea, is not yet authorized, but some studies [19,20] have reported the efficacy. After a two-dose regimen administered 21 days apart was its, efficacy, which consists of 5 μg of a recombinant nanoparticle spike protein plus 50 μg of Matrix-M (Novavax) adjuvant, was 86.3% (95% CI, 71.3%~93.5%) against the alpha variant and 96.4% (95% CI, 73.8%~99.4%) against non-alpha strains in healthy patients who were over 18 years of age.

Pfizer-BioNTech, Moderna, Janssen, and AstraZeneca vaccines were confirmed as safe vaccines through clinical trials, and although serious adverse reactions were rarely reported, the benefit of continuing the vaccination was evaluated as greater than the risk. After the phase 3 clinical study, the Janssen vaccine was available with a single-dose schedule, and the remaining three vaccines were approved with a two-dose schedule. All four are administered intramuscularly, and the approved age is over 12 for Pfizer-BioNTech, and over 18 for Moderna, Janssen, and AstraZeneca vaccines [16,21]. Any current U.S. Food and Drug Administration (USFDA)-authorized COVID-19 vaccine can be used when indicated; the Advisory Committee on Immunization Practices does not state a product preference. However, COVID-19 vaccines are not interchangeable. The need and timing for a booster dose for COVID-19 have not been established, and no additional doses are currently recommended. Any current USFDA-authorized COVID-19 vaccine can be administered to people with underlying medical conditions who have no contraindications to vaccination. However, myocarditis or pericarditis have occurred in some people (predominantly in males aged 12 to 29 years) following receipt of mRNA COVID-19 vaccines (Pfizer-BioNTech and Moderna), and Thrombosis with thrombocytopenia syndrome occurred primarily among women aged 18 to 49 years after Janssen [22] and AstraZeneca vaccination [23].

Vaccines need to maintain a cold chain from manufacturing

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to human inoculation because of the vulnerability of mRNA molecules. Pfizer–BioNTech and Moderna vaccines have low temperatures during storage and distribution, and long-term storage at refrigerated temperatures is impossible. Vaccine-related information is presented in Table 1. Also, since there are various types of COVID-19 vaccines and health-care professionals are not familiar with them, nurses should know the contraindications and possible side effects of each vaccine and correct vaccination and prepare for anaphylaxis at the location (Table 2) [21].

Table 1. Current COVID-19 Vaccines with Emergency Use Authorization

Vaccine name	BNT162b2/Comirnaty, Tozinameran (INN)	Moderna (mRNA-1273)	Janssen (Ad26.COV2.S)	AZD1222	NVX-CoV2373
Manufacturer†	Pfizer and BioNTech	Moderna and NIH	Johnson & Johnson	AstraZeneca	Novavax
Platform	Nucleoside-modified mRNA	mRNA-based vaccine encapsulated in lipid nanoparticle (LNP)	Viral vector (Recombinant, replication in competent adenovirus type 26 vectored vaccine encoding the [SARS-CoV-2] spike protein)	Viral vector (Recombinant ChAdOx1 adenoviral vector encoding the spike protein antigen of the SARS-CoV-2)	Recombinant nanoparticle prefusion spike protein formulated with Matrix-M™ adjuvant
Number doses	2	2	1	2	2
Interval between doses	21 day	28 day	N/A	8 to 12 wk	21 day
Authorized age group (yr)	12~15 and ≥ 16††	≥ 18	≥ 18	≥ 18	≥ 18
Efficacy	≥ 7 days after second dose: 95% (95% CI, 90.3%~97.6%)	≥ 14 days after second dose (all symptomatic): 94.1% (95% CI, 89.3%~96.8%)	≥ 14 days after single dose (all symptomatic): 66.9% (95% CI, 59.1%~73.4%	≥ 14 days after 2nd dose (all symptomatic): 70.4% (95% CI, 54.8%~80.6%)	95.6% (B.1.1.7. 85.6%, B.1.351 60%)‖
Route	IM (deltoid muscle)	IM (deltoid muscle)	IM (deltoid muscle)	IM (deltoid muscle)	IM (deltoid muscle)
Dose	30 μg (0.3 mL) Dilute with 1.8 mL pf 0.9% sodium chloride (normal saline, preservative-free)	100 μg (0.5 mL) Do not mix with a diluent	5×10^{10} viral particles (0.5 mL)	0.5 mL	5 μg
Administration conditions	After dilution, store vials 2℃~25℃ and use within 6 hours	Thaw in refrigerated conditions between 2℃~8℃ for 2 hours and 30 minutes. Before administering, let the vials stand at room temperature for 15 minutes Alternatively, thaw at room temperature between 15℃~25℃ for 1 hour	2℃~8℃ for up to 6 hours or at room temperature (maximally 25℃) for up to 2 hours	2℃~8℃ (48 h) Use within 6 hours after opening (below 30℃ after extraction of the first dose), discard on the same day	No information
Storage conditions	– 80℃ to – 60℃ (6 mo), 2℃~8℃ (5 day)	– 50℃ to – 15℃ (6 mo), 2℃~8℃ (30 day), 8℃~25℃ (12 h)	– 25℃ to – 15℃ (24 mo)	2℃~8℃ (6 mo)	No information

Table 1. Continued

Vaccine name	BNT162b2/Comirnaty, Tozinameran (INN)	Moderna (mRNA-1273)	Janssen (Ad26.COV2.S)	AZD1222	NVX-CoV2373
Contrain-dication	History of a severe allergic reaction (e.g., anaphylaxis) to any component of the Pfizer-BioNTech COVID-19 vaccine (including due to a known polyethylene glycol or polysorbate allergy). An immediate allergic reaction of any severity to a previous dose or known (diagnosed) allergy to a vaccine component. Moderate to severe acute illness.	History of a severe allergic reaction (e.g., anaphylaxis) to any component of the Moderna COVID-19 vaccine (Including due to a known polyethylene glycol or polysorbate allergy). Moderate to severe acute illness.	History of a severe allergic reaction (e.g., anaphylaxis) to any component of the Janssen COVID-19 vaccine.	History of a severe allergic reaction (e.g., anaphylaxis). Occurrence of thrombocytopenia after AstraZeneca Vaccination.	No information
Reported adverse events	Myocarditis, pericarditis, following the second dose and with onset of symptoms within a few days after vaccination[††].	Myocarditis, pericarditis, following the second dose and with onset of symptoms within a few days after vaccination.	Thrombosis with Thrombocytopenia syndrome)[§].	Thrombosis with Thrombocytopenia syndrome (cerebral venous sinus thrombosis, splanchnic vein thrombosis)[§].	No information
Common side effects	Pain at the injection site, tiredness, headache, muscle pain, chills, joint pain, fever, and lymphadenitis (more people experienced these side effects after the second dose).	Pain at the injection site, tiredness, headache, muscle pain, chills, joint pain, swollen lymph nodes in the same arm as the injection, nausea and vomiting, and fever (more people experienced these side effects after the second dose).	Pain at the injection site, headache, fatigue, muscle aches and nausea, fever of 38℃ or higher (symptoms are mild to moderate within 1∼2 days following vaccination and lasted 1∼2 days).	Pain at the injection site, headache, fatigue, muscle aches and nausea, fever, chills, joint pain.	Injection-site tenderness or pain, headache, muscle pain, and fatigue, fever (≥ 38℃), nausea, headache, fatigue, myalgia, malaise, and joint pain, erythema, swelling.
Use with other vaccine	No information on the co-administration of the Pfizer-BioNTech COVID-19 vaccine with other vaccines	No information on the co-administration of the Moderna COVID-19 vaccine with other vaccines In case of inadvertent cross-vaccination, additional vaccination is not recommended	No information on the co- administration of the Janssen COVID-19 vaccine with other vaccines	No information	No information
Authorized country	Australia, Canada, Germany, Israel, Korea, UK, USA	Canada, Germany, Korea, UK, USA	Germany, Korea, USA	Australia, Canada, France, Germany, Korea, UK	UK

CI = Credible interval; IM = Intramuscular; LNP = Lipid nano particle; NIH = National Institutes of Health; NN = International nonproprietary name; SARS-CoV-2 = Severe acute respiratory syndrome coronavirus-2.
[†]Pfizer-BioNTech, New York, NY, USA and BioNTech, Mainz, Germany; Moderna, Cambridge, MA, USA; Janssen Pharmaceuticals Companies of Johnson & Johnson, New Brunswick, NJ, USA; AstraZeneca, Cambridge, UK. [††]Updated July 16, 2021 by U.S. Food and Drug Administration. [§]Updated May 31, 2021 by Korea Disease Control and Prevention Agency, World Health Organization. [‖]B.1.1.7., first detected variant virus in UK; B.1.351, first detected variant virus in South Africa.

Table 2. Administration of Vaccine and Management of Anaphylaxis

The administration of vaccination is as follows:

1) Assess recipient status
   - Screen for contraindications and precautions
   - Review vaccination history
   - Review medical considerations
2) Choose the correct equipment, including the needle size. Use a new, sterile needle and syringe for each injection.
3) Cleanse the stopper on the vial of mixed vaccine with a new, sterile alcohol prep pad. Withdraw specified dose of vaccine into the syringe. Regardless of the type of syringe used, make sure the amount of vaccine in the syringe is the same volume. If vaccine is left in the vial, a full volume dose cannot be provided, discard the vial and contents. Do NOT combine vaccines from multiple vials to obtain a dose.
4) To avoid loss of vaccine, remove any significant air bubbles while the needle is still in the vial. Withdraw and administer the vaccine using the same needle. Make sure the prepared syringe is not cold to the touch.
5) For administration, bring the dose of vaccine from the preparation area immediately to the patient treatment area.
6) Nurses wear the correct personal protective equipment before administering vaccines and use face coverings for vaccine recipients older than two years (if tolerated).
7) Administer the vaccine immediately by intramuscular injection in the deltoid muscle.
8) Observe recipients after vaccination for immediate adverse reactions:
   - 15 minutes: All other persons
   - 30 minutes: People with a history of a severe, immediate allergic reaction to a vaccine or other injection therapy, or a history of anaphylaxis by other cause.
9) Confirmation of the person to be vaccinated; Nurses should check if the person has any of the following symptoms or conditions: allergies, fever, bleeding disorder or are on a blood thinner, immunocompromised, pregnant or planning to become pregnant, breastfeeding, have received another COVID-19 vaccine, have ever fainted due to an injection.

Preparing for the potential management of anaphylaxis after COVID-19 vaccination:

1) Early recognition of anaphylaxis: Symptoms of anaphylaxis often occur within 15 to 30 minutes after vaccination. Sometimes it can take several hours for symptoms to appear. Early signs of anaphylaxis might be similar to the following allergic reactions.
   - Respiratory: sensation of throat closing or tightness, stridor (high-pitched sound while breathing), hoarseness, respiratory distress (such as shortness of breath or wheezing), coughing, trouble swallowing/drooling, nasal congestion, rhinorrhea, sneezing
   - Gastrointestinal: nausea, vomiting, diarrhea, abdominal pain, or cramps
   - Cardiovascular: dizziness; fainting; tachycardia (abnormally fast heart rate); hypotension (abnormally low blood pressure); pulse difficult to find or "weak"; cyanosis (bluish discoloration); pallor; flushing
   - Skin/mucosal: generalized hives; widespread redness; itching; conjunctivitis; or swelling of eyes, lips, tongue, mouth, face, or extremities
   - Neurologic: agitation; convulsions; acute change in mental status; a sense of impending doom (a feeling that something bad is about to happen)
   - Other: sudden increase in secretions (from eyes, nose, or mouth); urinary incontinence.
2) Management of anaphylaxis at a COVID-19 vaccination location
   The following emergency medication and equipment should be prepared for the evaluation and immediate management of anaphylaxis; epinephrine, H1 antihistamine (e.g., diphenhydramine, cetirizine), bronchodilator (e.g., albuterol), Oxygen with mask, Blood pressure monitor, IV fluids, intubation kit.
3) If anaphylaxis is suspected, take the following steps
   - Rapidly assess airway, breathing, circulation, and mental activity.
   - Call for emergency medical services.
   - Place the patient in a supine position (face up) and feet elevated, unless there is upper airway obstruction, or the patient is vomiting.
   - Epinephrine (1 mg/mL aqueous solution [1 : 1,000 dilution]) is immediately administered as the first-line treatment for anaphylaxis. If the symptoms recur or do not improve while waiting for the emergency team, repeat the medication every 5 to 15 minutes.
   - Antihistamines (e.g., H1 or H2 antihistamines) and bronchodilators do not treat airway obstruction or hypotension and, therefore, are not first-line treatments for anaphylaxis. However, they can help relieve hives and itching (antihistamines) or symptoms of respiratory distress (bronchodilators). In particular, in the case of anaphylaxis, it should only be administered after epinephrine. Anaphylaxis can recur even after the patient begins to recover. Therefore, it is recommended to monitor the patient at a medical institution for at least 4 hours, even after symptoms or signs have completely disappeared.

COVID-19 GUIDANCE FOR FULLY VACCINATED PEOPLE: INFORMATION FOR HEALTH PROFESSIONALS

To control or eradicate COVID-19 successfully, a combination of several steps, including vaccination, surveillance of infected people, and reducing the susceptibility of infection, is required [24]. To be considered fully vaccinated, a person must have received the last dose 14 days ago if two doses are required or a dose 14 days ago if they received a single-dose vaccine, and they must be able to provide evidence of having received the full series of vaccines [25].

People are getting vaccinated despite the side effects to return to pre-COVID normal. However, that might be difficult without masks even if herd immunity is achieved. Since not all vaccinated people acquire a preventable level of immunity, people would have to adhere to a certain lifestyle with hygiene measures such as wearing masks and washing hands for a considerable period even if after vaccination [26,27]. As nurses are responsible for protecting people from the pandemic, they should be able to provide guidelines for those who have completed the vaccination.

1. Can people stop taking precautions after being vaccinated?

All viruses naturally mutate to form variants, and COVID-19 is not an exception. The infectious COVID-19 virus is responsible for millions of casualties worldwide. It is the cause of a pandemic, and its mutations form genetic variants that are yet to be fully understood. Recently, a fourth wave of COVID-19 has begun around the world [28].

Therefore, even countries with high vaccination rates strongly recommend wearing masks indoors and outdoors for persons joining large social gatherings. Moreover, to prevent the spread, fully vaccinated people should follow standard infection control measures such as sufficient ventilation and getting COVID-19 tests immediately after becoming symptomatic. The effects of vaccines against COVID-19 variant strains are still uncertain [6,29-32]. The results from the many ongoing studies indicate that vaccines are effective against some variants but less effective against others. Furthermore, the effects and duration of vaccines on immunosuppressed or immunocompromised individuals are still to be studied [24,33].

Although COVID-19 variants are emerging, vaccination is still the most effective countermeasure [6,25]. Therefore, until these variants are fully understood, and effective treatments are presented, we should ensure that people consider vaccination along with the prescribed preventative measures.

2. When fully vaccinated individuals had close contact with a person infected with COVID-19

Korea Disease Control and Prevention Agency revised infection control guidelines for individuals who are fully vaccinated against COVID-19, effective from July 5. When fully vaccinated individuals had close contact with patients infected with COVID-19, they were exempted from self-quarantine and not subject to active surveillance if they remained asymptomatic, and the close contact was not from outside the country [25,33].

Those individuals who are subject to active surveillance are monitored once a day at medical clinics, but those who are not subject to this monitor their health conditions themselves and contact medical clinics when they become symptomatic. Moreover, a diagnostics test, which was previously conducted three times, will be adjusted to once (six to seven days after the close contact) [33].

Even if the individuals leave the country two weeks after being fully vaccinated, they are not subject to active surveillance when they return to South Korea and meet the following criterion: asymptomatic and not coming from countries where Beta, Gamma, or Delta variants are common. The diagnostic test, which was previously conducted four times, is adjusted to two times (72 hours before returning and six to seven days after the return). However, even fully vaccinated individuals must receive the polymerase chain reaction test during the surveillance period. If non-compliant, they are subject to self-quarantine. Moreover, people must adhere to the infection control guidelines during the self-quarantine such as monitoring their health condition for 14 days, getting tested if they have even mild symptoms, wearing masks, minimizing going out, and avoiding crowds [33].

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Each country has different infection control guidelines when fully vaccinated individuals have close contact with people infected with COVID-19 [6,29-33]. These guidelines are shown in Appendix 1. However, with the recent increase in the number of infections caused by the variant, each country is considering changing its guidelines. As health professionals, nurses must recognize the up-to-date information and guidelines of COVID-19 to takes appropriate action to support and guide.

IMPACT OF COVID-19 ON THE NURSING WORKFORCE

The role of nurses during COVID-19 has been strengthened and is still being emphasized. More than a year and a half after the outbreak in early 2020, it is necessary to look at the global trends in changes in nursing personnel. According to a report of International Council of Nurses (ICN) in July 2020, after the COVID-19 outbreak, nurses have fallen ill or died from the poor provision of PPE and have experienced work-related stress and exhaustion [34]. According to the March 2021 ICN report, the number of nurses quitting has increased worldwide at a rate of one in five. Among them, 90% reported that excessive workload, insufficient resources, exhaustion, and stress are causing them to quit, which is a "serious or extremely worrying" situation, and collective trauma for health workers is a serious problem [35].

Compliance with IPC guidelines by healthcare workers has become even more important. Wearing masks and face shields, using PPE such as gloves and gowns, separation from respiratory infections, and particularly rigorous cleaning procedures can be difficult and time-consuming. In a qualitative review by Cochrane [36], nurses stated that their numbers per patient should increase because the work fatigue while wearing using PPE is very high in stressful situations, and it would be difficult for them to follow the IPC guidelines of hospitals if unrealistic workloads continue. To overcome this situation, ICN introduced three phases of COVID-19 influence and policy response and presented major nurse staffing policy problems at each stage [34]. In the first phase, First wave of COVID-19 impact, the focus is on increasing the overall nurse workforce and shifting more of them to intensive care unit or coronary care unit (ICU/CCU). The successful first step allows the national health system to address intensive care challenges in patients with acute COVID-19 symptoms. The second phase is Transition phase, which covers a period beyond the first immediate impact phase of COVID-19, a time when the system must maintain its ability to meet future waves, including the relocation of nurses by the department. In phase 3, The "New Normal", many countries need to improve public health and primary care delivery and achieve better integration with acute/hospital sectors to improve overall system responsiveness to COVID-19 or future epidemic outbreaks [34]. To attract new students to nursing programs and maintain existing nursing staff, recognition of nursing work, appropriate salaries, and awareness of a safe working environment are key. Investing in nursing staff and securing a solid foundation for nursing education and jobs is an essential step towards post-COVID-19 recovery and preparation for future pandemics [37]. The vast money spent on tackling COVID-19 and the deaths of countless nurses worldwide emphasizes the need for large investments to develop pandemic measures to protect and support nurses, which should be conducted at the government and the global level [38].

CONCLUSION

The curve of COVID-19 fluctuated and reached the fourth pandemic in July 2021. Since three waves, the focus has been on achieving herd immunity through vaccination while a lot of manpower is being used for quarantine. However, the fourth wave was not prevented, and it is likely to target the unvaccinated. While almost a quarter (24.7%) of the world population has received at least one dose of a vaccine against COVID-19, there are vast inequities in vaccine distribution and administration. The world should pay attention to the issue of inequality in vaccines.

Another thing to note is that each country has different infection control guidelines when fully vaccinated individuals have close contact with COVID-19 cases. Since major out-

breaks of COVID-19 cases affects the entire society, we need to continue taking serious measures. WHO, CDC, and each country have been regularly posting response guidelines for COVID-19. Moreover, they provide information on infection control principles and vaccines that healthcare professionals should know. Nurses must recognize up-to-date information and guidelines of COVID-19 to take appropriate action to support and guide. Also, nursing researchers and educators try to identify the essence of nursing required by the COVID-19 era through various studies and find the basis for appropriate scientific nursing [39].

We examined guidelines for preventing and managing COVID-19 and accurate information related to vaccination and described quarantine measures even for those who completed vaccination. We recommend vaccination with self-quarantine to overcome this 4th COVID-19 pandemic. Also, there is need for large investments to protect and support nurses in future pandemic measures.

CONFLICTS OF INTEREST

All authors have been the Editors of JKAN but have no role in the review process.

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DATA SHARING STATEMENT

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Appendix 1. The Guidelines of Different Countries for When Fully Vaccinated Individuals Had Close Contact with Those Who Have Confirmed or Suspected COVID-19

Country	Symptom tracker	Self-quarantine	PCR test
South Korea	Implemented	Done only in case of close contact with a person infected with COVID-19 variants	PCR test is performed on the day of contact, 6~7 days after contact, and 12~13 days after contact
United States	Implemented	Done if symptomatic	Performed if symptomatic
Canada	Implemented	Not done if tested negative	Performed immediately
United Kingdom	Implemented	10-day self-quarantine	Performed immediately
Israel	Implemented	14-day self-quarantine	Performed immediately

PCR = Polymerase chain reaction.