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Research article

Nurses' adaptations to changes on a COVID-19 ward in South Korea: A qualitative study

Won Lee [a], Jeehee Pyo [b], Minsu Ock [c], Seung Gyeong Jang [d], Eun Young Choi [a,*]

[a] Department of Nursing, Chung-Ang University, Seoul, Republic of Korea
[b] Task Forces to Support Public Health and Medical Services in Ulsan Metropolitan City, Ulsan, Republic of Korea
[c] Department of Preventive Medicine, Ulsan University Hospital, University of Ulsan College of Medicine, Ulsan, Republic of Korea
[d] College of Nursing, Inje University, Gimhae, Republic of Korea

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ABSTRACT

Background: Elucidating nurses' adaptation to changes in the early stage of an infectious disease epidemic is necessary to promote nurses' coping with and adapting to situations in which new infectious diseases are predicted periodically.
Aim: To explore nurses' adaptation to changes in COVID-19 wards in South Korea.
Methods: In-depth interviews were conducted with 20 nurses through purposive sampling from May to August 2020. The collected data were transcribed verbatim, and analysis was performed using conventional content analysis.
Findings: Three categories emerged from the interviews: (a) Disruption caused by an unforeseen pandemic outbreak, (b) perseverance through the turmoil of changes as a nurse, and (c) transition from feelings of fearfulness to those of accomplishment. While the nurses initially struggled to care for patients with COVID-19, they made conscious efforts to provide emotional nursing and maintain their professionalism.
Discussion: Nurses caring for patients with COVID-19 have faced a number of challenges but have adapted to new scenarios by endeavoring to fulfil their professional roles.
Conclusion: To overcome a national disaster situation such as COVID-19, the government and healthcare organizations should prepare strategies to support the efforts of nurses to strengthen their own professionalism.

1. Introduction

More than two years have passed since the COVID-19 pandemic that originated in Wuhan, China, in December 2019. As of December 2022, more than 600 million people worldwide have been infected with the virus, and 6 million people have died [1]. The development and implementation of vaccines and medicines have given us hope to end this crisis, but the emergence of viral mutations is still a risk [2].

Among healthcare providers, nurses are particularly exposed to a high risk of infection because they have the closest contact with infected patients and spend the most time with them [3]. Nurses have also been concerned about transmitting the infection to their families and friends [4,5], resulting in a dilemma between their responsibilities as a nurse and their choices as a family member [6]. In

* Corresponding author. Department of Nursing, Chung-Ang University, 84 Heukseok-ro, Dongjak-gu, Seoul 06974, Republic of Korea
E-mail address: eychoi@cau.ac.kr (E.Y. Choi).

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addition, during the COVID-19 pandemic, nurses experienced physical and mental health issues such as stress, depression, anxiety, burnout, and fatigue [7]. The negative emotions experienced by nurses can be long lasting [8], consequently affecting the quality of the patient care they provide [9].

Despite the negative experiences of nurses, some studies found that the pandemic acted as an opportunity for some nurses to discover the essence of nursing and grow professionally. Nurses did not relinquish their patient care responsibilities and maintained a sense of duty to their patients despite the fear of infection [6,10,11]. The public's high recognition and appreciation of nurses' contributions to infectious disease management gave nurses a sense of pride [4–6,10,12]. In addition, caring for patients with COVID-19 made nurses realize the importance of teamwork and collaboration with other health professionals [10,12–14] and became a learning experience that made them grow into resilient and competent nurses [5,6,10,12]. Such positive experiences can maintain nurses' dedication to their roles during this critical period [15].

In South Korea, the systematic management of the government has been considered relatively effective in curbing the spread of COVID-19 [16], but this effectiveness may have been possible thanks to the dedication of frontline healthcare providers. Therefore, elucidating nurses' adaptation to changes in the early stage of an infectious disease epidemic is necessary to promote nurses' coping with and adapting to situations in which new infectious diseases are predicted periodically. However, few studies have explored the experiences of nurses in the early stages of the COVID-19 outbreak in South Korea. The aim of this study is to explore nurses' adaptation to changes in COVID-19 wards in South Korea. In particular, in-depth interviews were conducted over four months after the onset of the pandemic in South Korea to identify nurses' experiences in various aspects of patient care.

2. Methods

2.1. Study design

This qualitative study was conducted using a content analysis approach based on the Consolidated Criteria for Reporting Qualitative Research (COREQ) [17]. Five researchers with extensive experience in qualitative research were included in our research team: three female nurses, one male physician, and one female researcher who majored in counselling. The first author (WL) and the corresponding author (EYC) led the research and were in charge of the content analysis. The first and corresponding authors are female, and there was no relationship between researcher and participants.

2.2. Setting and participants

The research setting was a tertiary hospital in Ulsan, which is one of the main infectious disease control institutions treating patients with COVID-19. The ward had five nationally designated isolation beds, and the other 48 beds were mainly for patients with digestive system diseases. As the cases of COVID-19 increased, the hospital ward used all its beds for patients with COVID-19. Upon a decrease in the number of patients with COVID-19, separate beds were allocated for patients with COVID-19 and other hospitalized patients. The participants were 1) nurses working in a COVID-19 ward and 2) nurses with experience caring for patients with COVID-19.

Purposive sampling was used to recruit frontline nurses who were willing to share their experiences about the research topic through the recommendation of the head nurse in the ward. Researchers provided the nurses with explanations regarding the research objectives and procedures. Subsequently, those who agreed to participate in the research were included. To maximize the participants' sharing of their experiences, the maximum variation sampling technique was utilized at the time of recruitment. Therefore, the participants were selected based on their position, number of years of total work experience, experience in the current ward, and age.

2.3. Data collection

We collected data through in-depth interviews conducted from May to August 2020. The first patient with COVID-19 in Ulsan was reported in February 2020, and the patient was treated at the hospital where the study was conducted. Since then, the number of patients with COVID-19 has increased rapidly in South Korea. For our study, data were collected through interviews over a period of four months to explore the experiences of nurses working on a COVID-19 ward from the first COVID-19 case to the time during which they became accustomed to handling COVID-19 cases.

In-depth interviews were conducted using a semi-structured interview guideline (S1 file). The interview guidelines were drafted with questions that could specifically explore the experiences and adaptations of nurses caring for patients with COVID-19 through several meetings with the research team members. Afterwards, the team members reviewed the draft through role play, and the final guidelines were completed by debriefing the progress.

The main questions were as follows: 1) Please explain how you felt about COVID-19 at the time of its first outbreak in China, South Korea, and Ulsan. 2) Please describe your experiences with caring for patients with COVID-19.3) Please explain the changes in your daily life, social life, and self-perception as a nurse while caring for patients with COVID-19.4) What improvements do you suggest for frontline nurses who are directly involved in caring for patients with COVID-19? Based on the extent of the participants' responses regarding their experiences with patients with COVID-19, the interviewer further asked questions such as "Please explain more about this," or "Why do you feel this way?" Moreover, probing questions that varied depending on the participants' years of experience and position were also used to achieve the research goals.

The interviews were conducted by the interview team, which consisted of one researcher who oversaw and led the interview

process and had ample experience in qualitative data collection and two nurses working in a hospital setting. Each interview lasted approximately 30–60 min, and data collection continued until the point of saturation, i.e., no more new themes emerged from the interviews. In this qualitative study, whether to continue or stop data collection was considered based on data saturation [18]. The interview was conducted until no more new themes emerged from the interviews, and the point of data saturation was determined through continuous discussion by the research team.

2.4. Data analysis

Data collection and analysis were conducted simultaneously using a conventional content analysis approach [19]. The interviews were transcribed verbatim. Two researchers (WL and EYC) read the transcripts several times to gain an understanding of the participants' perspectives and identified significant expressions. The researchers then classified and coded the data through comparisons and discussions. The codes were classified into categories that were more abstract based on their similarities. These categories were compared with each other and classified into higher-level categories. To ensure agreement and enhance rigor, the codes and categories were finalized through discussion among the research team members. Finally, a person with a Master's degree who obtained a bachelor's degree in the United States, is fluent in English and Korean, and is currently working in the preventive medicine department reviewed the English translation of the categories and statements. In addition, proofreading was performed by a professional translation company.

2.5. Trustworthiness

To assure the trustworthiness of the research, the criteria of applicability, consistency, and neutrality posited by Ref. [20] were used. The researchers tried to exclude preconceptions from the whole process of interviewing and analysis. The findings were shown to two nurses who participated in the study and to two nurses who had experience in caring for patients with COVID-19 but did not participate in the study. All nurses agreed with the identified findings, and one new nurse who did not participate in our study said that she had experiences similar to those reported in the findings.

2.6. Ethical considerations

Ethics approval was obtained from the institutional review board (approval number: 2020-04-041, date of approval: May 02, 2020). Researchers who conducted the interviews received written consent forms from all participants before the interview. When they obtained the written consent form, the researchers explained to the participants the anonymity of their participation in the research and their right to withdraw at any time.

3. Findings

Twenty nurses with a mean total work experience of 5.5 years and an average age of 28.9 years (minimum age of 25 years and a maximum of 46 years) participated in this study (Table 1). The three categories of findings included the following: disruption caused by an unforeseen pandemic outbreak, perseverance through the turmoil of changes as a nurse, and transition from feelings of fearfulness to those of accomplishment. Ten subcategories emerged from the analysis of the interview data (Table 2).

Table 1
Participants' characteristics.

ID	Gender	Age group (years)	Total Work Experience	Work Experience in the current ward
1	Female	30s	15 years	8 years
2	Female	20s	2 years 1 months	1 year 5 months
3	Female	20s	1 year 10 months	1 year 10 months
4	Female	20s	2 years	10 months
5	Female	20s	11 months	11 months
6	Female	30s	16 years	9 years 5 months
7	Female	30s	5 years	3 years
8	Female	20s	3 years 4 months	1 year 6 months
9	Female	20s	3 years	3 years
10	Female	30s	7 years	8 months
11	Female	20s	1 year 10 months	1 year 10 months
12	Female	40s	25 years 2 months	12 years 2 months
13	Female	20s	4 years 4 months	2 years
14	Female	30s	5 years	2 years 5 months
15	Female	20s	1 year 2 months	1 year 2 months
16	Female	30s	7 years	4 years
17	Female	20s	1 year 6 months	10 months
18	Female	20s	1 year 4 months	1 year 4 months
19	Female	20s	3 years 2 months	3 years 2 months
20	Female	20s	4 years	11 months

3.1. Disruption caused by an unforeseen pandemic outbreak

3.1.1. Fear of facing new infectious diseases without any preparation

When the first COVID-19 outbreak occurred in China, it was not a domestic situation. Therefore, the participants thought that it was a distant story. However, when the COVID-19 outbreak occurred in South Korea, followed by Ulsan, the participants had to prepare themselves to care for patients with COVID-19 patients stating, "they became the patients that I had to take care of."

> "The moment when a COVID-19 case occurred in Korea and the first COVID-19 case occurred in Ulsan … I think I felt pressure because the ward changed in an instant. Hospitals are not asking us to prepare for treatment for patients with COVID-19 within a week or two, but because they are planning to build a negative pressure ward in 3–4 days, they are asking us to take care of the patient …" (Participant 4)

Due to the unknown nature of the virus, the participants were worried and wary of becoming infected while caring for patients with COVID-19 during their first encounters.

> "When the first patients with COVID-19 came, all the nurses were nervous, and we were at the point where we didn't know what kind of patient or disease it was, so we were cautious about everything and scared of everything." (Participant 11)

In particular, the nurses with less work experience said that they were afraid of being immersed in the process without any preparation.

> "There were a lot of cases where nurses with little experience had to provide nursing directly to patients with COVID-19. So it was a bit burdensome, and even after going inside, I was a bit scared to take care of the patient." (Participant 9)

3.1.2. Disarray from recurrent changes in the infection control system

At the beginning of the COVID-19 outbreak, the infection control system within the organization was not properly established. In particular, the COVID-19 control manuals changed frequently; thus, it was difficult for the nurses to monitor their content.

> "There was confusion among the nurses in the ward, and it was the first time the doctors had it, so we didn't know what to do. The guidelines continued to develop, change every 30 minutes on the same day, change every hour, and change repeatedly. They kept changing with new patients, especially new cases …" (Participant 6)

In addition, communication among the infection control department, other departments, and medical staff was ineffective. Due to this insufficient communication, the participants found it difficult to adapt to the fluctuating requirements of COVID-19 patient care.

> "There are many things that need to be done collaboratively rather than being performed by a nurse alone. Every time we care for a patient, we ask each other questions and check it out, so it takes a while. When communication is not good, we were not ready, but the patient was waiting for us on the ward first." (Participant 13)

3.1.3. Work burden due to reconstruction of nursing tasks and environment

There were times when the nurses had to perform additional tasks unrelated to their main duties (such as cleaning and providing meals) that were previously performed by other staff, resulting in an increased workload.

> "The division of work was not done well. What on earth is the scope of a nurse's job? From sweeping the floor, wiping the toilet in the bathroom, and cleaning the drains … in the beginning, I did a lot of things like that." (Participant 14)

In addition, due to the nature of COVID-19, they had to wear personal protective equipment, which caused difficulties in providing nursing care, such as obstructing their vision due to moisture and decreasing sensation in their hands due to gloves. Furthermore, to minimize as much contact as possible, the patients were observed, and their conditions were assessed using telephones or CCTV. Moreover, the number of face-to-face observation rounds was reduced; thus, it was difficult for the participants to provide active

Table 2
Categories and subcategories of the study.

Categories	Subcategories
1. Disruption caused by an unforeseen pandemic outbreak	1-1. Fear of facing new infectious diseases without any preparation
	1-2. Disarray from recurrent changes in the infection control system
	1-3. Work burden due to reconstruction of nursing tasks and environment
	1-4. Psychological distress due to lack of support for COVID-19 patient care
2. Perseverance through the turmoil of changes as a nurse	2-1. Choosing arbitrary isolation to reduce the risk of infection
	2-2. Tolerating the reactions of those around them who treated nurses as potentially infected
	2-3. Becoming familiar with caring for patients with COVID-19
	2-4. Acquiring knowledge and skills to care for patients with COVID-19
3. Transition from feelings of fearfulness to those of accomplishment	3.1. Realizing the importance of providing holistic nursing care
	3-2. Developing a sense of professional self-efficacy as a nurse

nursing care. The nurses also mentioned facing difficulties in solving issues regarding COVID-19-related regulations, such as conducting blood tests at different intervals and providing adequate supplies. They also had to bear with patient complaints.

> "I put on goggles and a mask and go in like this. When I wear it, I sweat too much. Sometimes I get dizzy when I sit down and get up once. (…) I think wearing personal protective equipment was a bit difficult. I had to do a blood test on the patient wearing gloves. Patients like it only if the blood test is successful at once. It was also a little burdensome, and I think this was also a big deal." (Participant 8)

3.1.4. Psychological distress due to lack of support for COVID-19 patient care

Although personal protective equipment was necessary to care for patients, in some cases, the provision of such equipment was insufficient. Moreover, there was a lack of support for accommodation, meals, and rest. In particular, the urgent installation of temporary walls made participants think that these environments were not protected against infection.

> "Gradually, all the patient rooms in the ward were replaced with negative pressure rooms, and they started making them in a hurry. It is said to be a professional facility, but it only has the equipment; it seems to be lacking in terms of safety. So there were times when I had my doubts. Is it true that this works? Sometimes I wonder if nurses are actually properly protected." (Participant 11)

In addition, due to the unprecedented nature of the outbreak, the nurses that cared for patients with COVID-19 faced exhaustion that was more mental than physical. Insufficient psychological support was provided to the participants during this time.

> "I think the mental aspect is more exhausting than the physical aspect. Whether or not I care for a COVID-19 patient, the national situation of COVID-19 is not an everyday situation. I'm not really sure if the nurses are getting adequate support." (Participant 1)

3.2. Perseverance through the turmoil of changes as a nurse

3.2.1. Choosing arbitrary isolation to reduce the risk of infection

Since COVID-19 is an infectious disease, the participants isolated themselves to avoid becoming a vehicle for transmission. They refrained from going out, lived only in dormitories, gave up their daily lives, such as by not visiting their families, and continued traveling to and from the hospital.

> "At first, this extreme situation related to COVID-19 continued for almost a month and a half to two months; not only me but also other nurses went from the dormitory or house to the hospital and again from the dormitory or house to the hospital in a pattern like this …." (Participant 3)

Some of nurses reacted skeptically when they saw other peoples' posts on social network sites (SNS) highlighting that the latter traveled or lived freely. Nevertheless, almost all of the participants lived their lives constraining themselves due to their responsibilities as nurses caring for patients with COVID-19.

> "It must be a sense of responsibility. That's a professional responsibility because while I work in this ward, I have a strong feeling of being responsible for my actions." (Participant 1)

3.2.2. Tolerating the reactions of those around them who treated nurses as potentially infected

The participants were hurt by the negative reactions and attitudes of people around them toward caring for patients with COVID-19. Participants who directly cared for patients with Middle East Respiratory Syndrome (MERS) paid more attention to the reactions of those around them based on their previous experience of negative social perceptions surrounding medical staff who cared for patients with MERS. In addition, medical staff from other departments working in the same hospital avoided nurses working in the COVID-19-dedicated ward due to their preconceived notions about the virus. However, the participants silently endured the reactions of those around them, thinking that they had to work hard to accomplish their duties.

> "Someone said that last time. Potential COVID-19 patient? They talked of us (nurses who work in the COVID-19 ward) like that. Talking like that, I still don't feel good. (…) Looking at us with a preconceived notion that we may have the virus, it was actually a bit difficult. (…) Maybe … Ah, this is the fate given to me. And although it was difficult and tough, I always worked with the thought that I had to work hard to overcome this situation." (Participant 12)

3.2.3. Becoming familiar with caring for patients with COVID-19

Over time, the infection management system within the hospital was consolidated, reducing confusion among the participants.

> "At first, I was a little nervous because I didn't know what to believe and what to do. (…) Now, the infection control office notices accurately, or you can contact the infection control office if you don't know, so I think that my fear has decreased a lot." (Participant 15)

In addition, as the issues and suggestions communicated by the nurses were acknowledged to some extent, the work environment

improved compared with the beginning of the pandemic. Participants mentioned that they became accustomed to caring for patients with COVID-19 and started caring for them in the same way they did for other patients in the past.

> "As COVID-19 becomes a long-term battle, now there is a system to some extent. So even if a patient with COVID-19 is admitted, the reaction is 'Oh, a patient is coming, and now I'm just taking care of him or her like a normal patient.' I guess it's because I'm used to it." (Participant 16)

3.2.4. Acquiring knowledge and skills to care for patients with COVID-19

To care for patients with COVID-19, the nurses, along with their colleagues, worked together to acquire additional knowledge and skills. They paid more attention to areas they had not been concerned about previously, and they studied hard by identifying materials related to COVID-19. They felt the need to build their skills to prepare in advance for situations that might arise again.

> "I am here because I want to take care of a patient, but it was mentally difficult because I thought that I could not do it. (Omitted) From that day on, I started studying with my colleagues about the care that can be provided to patients with COVID-19. Study, study, and study with a new mind." (Participant 11)

3.3. Transition from feelings of fearfulness to those of accomplishment

3.3.1. Realizing the importance of providing holistic nursing care

Among COVID-19 patients, many complained of anxiety or psychological suffering. In particular, some patients struggled with their feelings when they were diagnosed with COVID-19 and were stressed about its negative impact on their family and friends. As the participants were taking care of these patients, they realized the importance of providing holistic nursing care by considering the patients' perspectives. Nurses came to think that holistic nursing care was more than empathy for patients and that they improved at coping with patients' emotional turmoil. Therefore, if they previously provided nursing care for curative purposes, they now actively tried to provide holistic care.

> "In the past, I cared for patients for therapeutic purposes; these days, I am trying to provide a lot of emotional care in addition to therapeutic care (…) I strive to take good care of the psychological aspects of patients, and I try to listen to their grievances. The only people they can talk to are family members over the phone and the nurses who they are in contact with at the hospital, so I try to talk to them and support them emotionally." (Participant 3)

3.3.2. Developing a sense of professional self-efficacy as a nurse

In the past, our participants often did not feel rewarded as nurses. However, after caring for patients with COVID-19, they felt more rewarded, were proud of their profession, and had an increased sense of responsibility.

> "Before COVID-19, I didn't have time to feel rewarded because I was immature and didn't do my job well. It's different now. People recognize that we are working so hard for patients, and compared to before, more patients say, 'Thank you a lot' to the nurses." (Participant 15)

Initially, one participant mentioned being worried about her capabilities in helping other nurses and patients due to her limited work experience. However, with time, she felt more confident as a medical professional who could effectively provide care for patients with COVID-19 and said that she was proud of herself.

> "On the first, second, and third days, there wasn't much I could do while nursing patients with COVID-19, but gradually I came up with things I could do. At that time, I felt proud as I thought that there was something I could do. When caring for patients became my satisfaction, I also thought that I was good at becoming a nurse." (Participant 11)

4. Discussion

This study explored nurses' adaptation to changes working in a COVID-19 ward of a tertiary hospital. We derived three categories from the interviews: (a) disruption caused by an unforeseen pandemic outbreak, (b) perseverance through the turmoil of changes as a nurse, and (c) transition from feelings of fearfulness to those of accomplishment.

In the early stages of the pandemic, information about the novel coronavirus was not well known; thus, nurses and other healthcare providers were very afraid of infection and transmission [13]. This applied to our nurses as well. Poor response systems to infectious diseases and a lack of personal protective equipment could further deepen this fear [5]. However, our participants chose to maintain their responsibility of caring patients and live in isolation. The dedication of these nurses was heightened, particularly in times of crisis [8,21], playing a key role in the management and control of this pandemic [22,23].

In our study, the nurses experienced a number of difficulties that have already been reported in the literature, such as unfamiliarity with nursing for patients with COVID-19, insufficient response system, lack of physical and psychological support, and social stigma [5–7]. However, they tried to resolve these challenges without becoming frustrated and adapted to the new scenarios. As noted by some of our participants, their resilience could have originated from teamwork [8,23]. For nurses who led isolated lives without receiving support from family or acquaintances, the camaraderie among colleagues could have played an important role in their

adaptation and could have mitigated the negative effects experienced by nurses [4,14]. Moreover, participants acquired knowledge and skills to better understand the needs of patients with COVID-19 and to provide high-quality care and expressed their opinions on improving the environment. The new experience of nursing patients with an emerging infectious disease provides nurses with opportunities to grow into more resilient and competent nurses [5,6,10,12], and the professionalism of nurses should be regarded as a strength, especially in times of crisis such as COVID-19.

Furthermore, our nurses realized the importance of holistic nursing care. In South Korea, the lack of nursing staff is a critical problem [24], and nurses are fully occupied with providing disease-focused care, such as medication and treatments, during working hours. As a result, nurses are not able to give more attention and responses to their patients, causing them to feel worthless and consider resignation, thereby increasing turnover [25]. However, while caring for patients with COVID-19, nurses discovered the essence and value of nursing that were previously undiscovered and thus could work more diligently [15].

As shown by our findings, the dedication and professionalism of nurses were evident in the context of a global disaster. The public and media portrayed nurses as heroes and angels. Some nurses have benefited from this social recognition [22]. However, such an image risks concealing the difficulties experienced by nurses, causing their sacrifices to be taken for granted [26]. As the pandemic remains ongoing, nurses will increasingly burn out, decreasing their intentions of job retention [27]. In the fight against COVID-19 and in similar situations that may arise in the future, nurses' professionalism is essential. Therefore, it is necessary to support nurses and eliminate any barriers they face.

For all nurses to work safely and free from the threat and fear of infection, it is necessary to improve their working environment by providing training on the use and disposal of personal protective equipment along with a sufficient supply of personal protective equipment [28], by providing appropriate meals and rest, and by placement and expansion of nursing personnel according to the severity and nursing needs of patients [29]. In addition, appropriate social support systems, such as psychological support and financial compensation, should be provided to mitigate the negative impacts of COVID-19 experienced by nurses [4]. Finally, even if the pandemic ends, social interest and policy support for nurses should continue to contribute to the health of all patients.

This study has the following limitations. First, this study explored the experiences of nurses working in the COVID-19 ward of a government-designated tertiary general hospital; thus, there may be differences in nurses' experiences depending on the hospital size and patient case mix. Second, the participants in this study were all female, and male nurses were not included; therefore, gender differences in adaptation could not be considered. Third, as this study was conducted at the beginning of the pandemic, interpretation of the results should take this into account.

Despite these limitations, the participants' experiences were similar to those of nurses in different countries at different times during the pandemic. Thus, the discussions and recommendations can be applied in a larger context. In addition, the results of this study may help in preparation of support strategies that can accelerate nurses' coping and adaptation in the event of a new infectious disease epidemic.

5. Conclusion

Nurses caring for patients with COVID-19 have faced a number of difficulties including a high risk of infection, a disorganized infection management response system, lack of support in general, and negative reactions from those around them. However, nurses have adapted to these new scenarios by endeavoring to fulfil their professional roles. In order to overcome a national disaster situation such as COVID-19, it is necessary to prepare a national strategy to support the efforts of nurses, to strengthen their own professionalism.

Author contribution statement

Won Lee; Eun Young Choi: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Jeehee Pyo: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data.

Minsu Ock; Seung Gyeong Jang: Conceived and designed the experiments.

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Data availability statement

Data included in article/supplementary material/referenced in article.

Declaration of interest's statement

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

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