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Need for Information and Communication Technology during COVID-19: An Exploratory Study Using Nurses' Activity Diaries

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Objectives: The coronavirus disease 2019 (COVID-19) pandemic has led to high levels of burnout among nurses. Information and communication technology (ICT) may offer a solution to prevent a potential collapse in healthcare. The aim of this study was to identify areas where ICT could provide support, by analyzing the work of nurses during the COVID-19 pandemic. **Methods:** This retrospective exploratory descriptive study analyzed qualitative data from the activity diaries of seven nurses working in COVID-19 wards or intensive care units. **Results:** The nursing work process during COVID-19 involved "added tasks," "changed tasks," and "reduced tasks" compared to the pre-COVID-19 situation. Nurses reported difficulties in communicating with other healthcare professionals both inside and outside the isolation room, as well as with patients. The use of various ICT solutions, such as real-time video-conferencing systems or mobile robots, could enhance patient monitoring in the isolation room and improve the quality and efficiency of communication. **Conclusions:** The changes in work tasks not only led to nurse exhaustion but also negatively impacted the quality of care. ICT solutions should be explored to minimize the time spent in the isolation room, thereby reducing the risk of infection spread. This could also enhance communication among patients, family caregivers, and healthcare professionals.

Keywords: COVID-19, Patient Isolation, Information Technology, Nursing Care, Workload

I. Introduction

Coronavirus disease 2019 (COVID-19), a respiratory infection caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has spread rapidly worldwide since its initial outbreak in Wuhan, China in December 2019. The World Health Organization [1] declared it a pandemic on March 11, 2020, signifying the outbreak as a significant threat to global public health [2]. Amidst this pandemic, nurses, who play a crucial role in combating COVID-19, have experienced an unprecedented level of stress. This stress poses a threat to their physical and psychological health, their well-being, and the quality of care they provide to their patients [3]. As frontline healthcare workers, they

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dedicate a significant amount of time to providing direct care to affected patients.

The workload and working hours of nurses have significantly increased due to the influx of COVID-19 patients [4]. The implementation of prophylactic measures, such as donning and doffing protective equipment, carrying out specific decontamination procedures, and managing isolation zones, has further added to the nursing workload [5]. In particular, the necessity of wearing a full set of personal protective equipment (PPE) for extended periods induces tension and fatigue, thereby exacerbating the challenges of nursing work [5,6]. With visitation restrictions in place due to the highly contagious nature of COVID-19, nurses have also had to assume the roles typically played by patients' families [5]. The surge in COVID-19 patients, coupled with a severe shortage of material and human resources, has made it increasingly difficult for nurses to perform their regular duties [7].

Nurses have experienced high levels of burnout during the COVID-19 pandemic. Preliminary reports have identified several factors contributing to this burnout, including an excessive workload, a high risk of infection, emotional exhaustion, and a limited availability of both material and human resources when caring for COVID-19 patients [7,8]. This burnout among nurses directly leads to a high turnover rate and decreased efficiency in their daily work. This could potentially lead to the collapse of a sustainable healthcare system, especially with the prolongation of the COVID-19 pandemic [9]. Additionally, healthcare organizations have struggled to meet staffing demands and have been unable to provide frontline workers with adequate supplies and PPE [10]. Consequently, the COVID-19 situation has had a profound impact on nurses and the quality of nursing. There is a pressing need to explore work processes and nursing routines in order to reduce nurse burnout and improve their work environment [4,7].

It has been reported that information and communication technology (ICT) can aid in nursing and medical tasks [11]. In particular, the COVID-19 pandemic has underscored the role of ICT as a potential solution to prevent a potential medical system collapse due to nurse burnout and decreased work efficiency [12]. With the global spread of COVID-19, numerous studies have investigated the factors affecting nurses' physical and mental health. However, there is a lack of prior research analyzing nursing work for ICT utilization. It is crucial to understand which types of ICT can assist with the daily incidents that occur in COVID-19 wards.

This study aimed to explore the areas where ICT support is possible through an analysis of nursing work. By examining the tasks involved in caring for COVID-19 patients and identifying the needs of nurses, efficient ICT interventions can be developed. This approach will not only help to lessen the workload of nurses, but also lay the groundwork for a robust healthcare system capable of handling national crises.

II. Methods

1. Research Design and Sample

This retrospective exploratory study analyzed the qualitative data derived from nurses' activity logs. The research involved seven nurses employed in the COVID-19 ward, intensive care units, and community treatment centers across six medical institutions. Participants were sourced through network recruitment, a strategy selected to ensure a diverse representation of hospitals and wards, including intensive care units, internal medicine wards, and community treatment centers.

2. Measures and Data Collection

A structured activity diary was used to collect data from September 2021 to October 2021 (Appendix 1). This diary format was originally developed by Oddsdottir and Sveinsdottir [13], and we adapted it to suit the specific needs of this study, drawing on the work of Humphreys et al. [14]. Activity diaries can be either structured or unstructured, offering a framework for collecting large amounts of data and recording situations in real time [15]. These diaries and logs have proven useful in capturing the impact and complexity of activities, as well as in examining the work practices of healthcare professionals [14]. Goemaes et al. [16] employed an activity diary, also developed by Oddsdottir and Sveinsdottir [13], to study how advanced practice nurses use their time and to investigate how time usage varies based on factors such as the type of healthcare organization, work experience, and supervisor. Sveinsdottir et al. [17] used this method to document and reflect on the actual work activities of nurse unit managers in surgical and internal medicine services, as described in their job descriptions. This method is particularly useful for understanding changes in work practices, especially in situations where accessing the ward is challenging due to the infectious nature of COVID-19.

In previous studies conducted by Oddsdottir and Sveinsdottir [13] and Humphreys et al. [14], nurses were instructed to document their tasks at 15-minute intervals throughout their shifts. However, the objective of this study was to generate primary data to aid in the development of ICT interventions. These interventions aim to pinpoint and address

the inefficient and time-consuming aspects of nursing work during the COVID-19 pandemic. As such, we modified the 15-minute interval recording method to instead document the time each task took to complete, without any time constraints. Instead of providing a pre-coded task list, nurses were asked to write down their tasks directly. This was done to identify any tasks that were added or newly introduced due to COVID-19. To gauge the difficulty level of each task, we utilized a 5-point Likert scale. If a task was deemed particularly challenging, the reason was noted. While there is no universally agreed-upon sample size for this type of study, Humphreys et al. [14] used a sample of six participants, and Oddsdottir and Sveinsdottir [13] included 15 nurses in their research. Following their methodologies, our study also recruited a sample of seven nurses. Each nurse was given an activity diary via email and asked to record their tasks. Detailed records were necessary to identify any suggestions from the nurses or problems that arose during each task. However, due to the difficulty of recording detailed notes while wearing PPE, the nurses completed their activity diaries by recalling their tasks from the previous 7 days.

3. Data Analysis

Three members of the project team independently and collectively reviewed the completed diaries for errors and ambiguities. Any queries or sections that required further investigation were identified and subsequently discussed with the participants through email or phone interviews.

A thematic analysis was conducted using the activity diary, which entailed a systematic evaluation of each entry. Activities were categorized according to their respective work types, and any tasks added due to COVID-19 were identified by creating a new category. A comparative analysis was then performed, focusing on tasks that were reduced, expanded, or altered. For the quantitative aspect of the work difficulty analysis, descriptive statistics were computed using Microsoft Excel version 16.0.

4. Ethical Considerations

This study was conducted in accordance with the World Medical Association's Declaration of Helsinki on Ethical Principles for Medical Research Involving Human Participants. Also this study was approved by the Institutional Review Board of Gachon University on July 15, 2021 (No. 1044396-202106-HR-125-01).

III. Results

1. High-Frequency Tasks Time Required for Tasks, and Difficulty of Tasks

All the participants in the study were women, with an average employment duration of 7.3 years and an average age of 31.6 years. The most common task was donning and doffing PPE, which on average took 12.1 ± 3.1 minutes and 11.7 ± 5.4 minutes, respectively. The task that required the most time was inpatient and transfer nursing, taking an average of 51.3 ± 35.1 minutes. The task perceived as the most difficult was changing positions, scoring an average difficulty rating of 4.6 ± 0.4 points (Table 1).

2. Changes in Tasks during COVID-19

Since the outbreak of COVID-19, numerous new nursing tasks have emerged, while existing tasks have either been reduced or adapted. The new tasks include cleaning and environmental management, patient transfer, preparation for sample transfer, donning and doffing PPE, and organizing and delivering patient parcels. Adapted tasks encompass admission nursing assessment, vital sign checks, communication within and beyond the isolation room, procurement of material resources, allocation of additional human resources, position changes, and obtaining guardian consent for treatment and procedures. Tasks that have been reduced include nurse handovers, physician rounds, nurse rounds, discharge education, family caregiver visits, and explaining patient conditions (Table 2, Figure 1, Appendix 2).

IV. Discussion

Given the ongoing global impact of the COVID-19 pandemic and the critical role nurses play in addressing this public health crisis, this study has highly significant findings. This study illuminated specific areas where ICT support can reduce nurses' workload and improve their working conditions, thereby contributing to the creation of targeted interventions and bolstering the overall resilience of healthcare systems in times of national crisis. Moreover, the distribution of these research findings and the encouragement of further related studies will promote collaboration and the exchange of knowledge. This will empower healthcare professionals and policymakers to make well-informed decisions and put into action effective strategies to tackle the challenges brought about by the pandemic.

Upon analyzing the activity diaries kept by the nurses, we found that the nursing work process involved "additional

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Table 1. Time required and mean difficulty for each task (n = 7)

Task	Frequency of task working shift	Task time required (min)	Task difficulty[a]
Body weight measurement	1.0 ± 0.0	12.8 ± 0.3	4.0 ± 0.0
Dressing	2.0 ± 1.0	12.8 ± 0.3	3.8 ± 0.2
I/O count	4.0 ± 1.6	13.4 ± 4.3	4.0 ± 0.8
PAPR preparation check and wear	1.0 ± 0.0	17.5 ± 12.5	2.5 ± 1.5
Suction	4.5 ± 2.5	14.5 ± 2.0	3.8 ± 0.2
V/S	4.4 ± 1.0	14.4 ± 6.5	3.7 ± 1.0
X-ray	1.0 ± 0.0	10.5 ± 0.5	4.5 ± 0.5
Nursing record	4.0 ± 2.2	31.0 ± 15.7	1.9 ± 0.5
Examination (blood collection)	3.0 ± 1.3	20.3 ± 9.9	3.7 ± 0.7
Sample preparation	3.0 ± 0.8	19.1 ± 6.1	3.1 ± 0.5
Diaper change	6.0 ± 0.0	13.4 ± 9.0	4.1 ± 0.6
Arrangement and inspection of materials	3.3 ± 2.3	11.9 ± 1.9	3.2 ± 1.1
Disposal of materials	1.7 ± 0.9	13.6 ± 2.0	4.3 ± 0.9
Assistance in defecation and urination	3.7 ± 1.7	12.6 ± 1.5	4.3 ± 0.5
Bed preparation	1.0 ± 0.0	21.8 ± 13.9	3.8 ± 1.1
Putting on PPE	6.0 ± 2.5	12.1 ± 3.1	2.7 ± 0.4
Taking off PPE	6.0 ± 3.0	11.7 ± 5.4	2.8 ± 0.4
Meal assistance	2.5 ± 0.9	14.6 ± 3.5	4.3 ± 0.4
Adjustment of equipment such as mechanical ventilator	2.0 ± 0.8	12.8 ± 1.7	3.7 ± 1.2
Inpatient and transfer nursing	1.0 ± 0.0	51.3 ± 35.1	4.3 ± 0.8
Position change	4.7 ± 1.2	12.6 ± 7.4	4.6 ± 0.4
Communication with other healthcare professionals	3.5 ± 2.1	31.4 ± 22.8	3.6 ± 0.4
Discharge nursing	1.3 ± 0.5	22.5 ± 6.1	3.7 ± 0.5
Medication	5.6 ± 2.7	15.6 ± 3.4	3.9 ± 0.6
Medication preparation	3.8 ± 2.0	26.0 ± 9.3	2.2 ± 0.5
Environmental management (including cleaning and disinfection)	3.0 ± 1.6	20.2 ± 4.5	3.8 ± 0.7
Patient assessment	3.3 ± 1.3	13.8 ± 5.1	3.6 ± 0.4
Patient handover	3.2 ± 0.7	29.3 ± 5.0	2.2 ± 0.7
Patient identification and prescription confirmation	4.0 ± 1.5	32.2 ± 14.4	2.3 ± 0.6
Rounds	1.5 ± 0.5	20.0 ± 10.0	4.0 ± 0.0
Rest (including nurse's meal)	4.4 ± 1.2	31.0 ± 9.4	0.7 ± 0.9

Values are presented as mean ± standard deviation.

I/O: intake/output, PAPR: powered air purifying respirator, V/S: vital sign, PPE: personal protective equipment.

[a]Using a 5-point Likert scale: 1 (very easy), 2 (easy), 3 (moderate), 4 (difficult), and 5 (very difficult).

tasks," "changed tasks," and "reduced tasks" compared to the pre-COVID-19 situation. Among the "additional tasks," the most frequently occurring task was the donning and removal of PPE.

Regarding PPE, participants reported difficulties with vision and breathing, as well as a sense of impaired mobility. They also noted that it was challenging to promptly and accurately assess a patient's condition while wearing PPE. The process of donning and removing the protective gear was particularly difficult without assistance from other staff members [18]. The strain of repeatedly putting on and taking off PPE, as well as the fatigue associated with this process, was previously highlighted in a 2015 study on Middle East respiratory syndrome (MERS) [19]. Given that nurses

Table 2. Comparison table of tasks before and during the COVID-19 pandemic

	Classification	COVID-19	Usual care	Possible ICT solution[a]
Added tasks	Cleaning and environmental management	When working without wearing PAPR, nurses' work intensity increases. As a limited number of people are allowed to enter, works related to waste disposal, cleaning after leaving, and managing the environment are burdened on nurses. Therefore, indirect nursing time performed by nurses increases.	There is support from dedicated cleaning personnel.	Cleaning and disinfection robot [A1,A2] Transfer robot [A3,A4]
	Patient transfer	Nurses are responsible for the overall route for admission and discharge, and the arrangement of confirmed patients.	There is support from dedicated transfer personnel.	Guide robot [A5]
	Standby in the isolation room	When a bedside portable examination (e.g., chest X-ray) is scheduled, it is often necessary to wait in the isolation room until the examiner enters to avoid frequent changing of clothes.	Indirect nursing (e.g., recording) is possible while waiting.	Speech-to-text electronic medical record [A6]
	Sample transfer preparation	The nurse's work of sterilizing and wrapping the bottle after collecting samples such as blood.	After the nurse collects the sample, apply for transfer of the bottle according to the protocol.	Transfer robot [A3,A4]
	Wearing and removing PPE	It is challenging to secure vision, breathing, and movement due to putting on and taking off of the PPE. As the senses are also dulled, it is impossible to identify the patient's condition promptly, and it is difficult to make decisions by determining the condition. A considerable amount of energy is consumed to safely remove PPE while the physical strength is already exhausted.	If it is not an infectious disease, wearing PPE is unnecessary.	Remote monitoring [A7], telecommunication technology [A8]
	Arrangement and delivery of patient parcels	As family caregivers cannot visit, the nurse's work was added to receive, organize, and deliver personal items necessary for patients through a separate parcel.	The family caregiver prepares the necessary items to enter.	Transfer robot [A3,A4]

Continued on the next page.

Table 2. Continued

	Classification	COVID-19	Usual care	Possible ICT solution[a]
Changed tasks	Admission nursing assessment	In the case of those who can communicate among those at home or in the community treatment center, while waiting for hospitalization, nursing information is written in advance through phone calls.	After admission, the nurse directly interviews the patient or family caregiver (if the patient has difficulty responding).	Telecommunication technology [A9]
	V/S check	In the case of patients with clear consciousness, the blood pressure and body temperature are self-measured and reported.	The nurse measures.	Tablet input application connected to electronic medical record Wearable device linked with EMR [A10]
	Communication inside and outside the isolation room	Communication between healthcare professionals inside and outside the isolation room is difficult. Communication using a call bell is difficult due to wearing a mask.	If it is not an isolation room, it is possible to communicate directly with the station. The isolation room allows easy access and facilitates call bell use.	AI speaker [A11], Bluetooth earphones, smartphone application, real-time video-conferencing program [A8], and Smart glass
	Procurement of material resources	As free access to the isolation room is not possible, healthcare professionals must prepare all the items in advance and enter the room, and other healthcare professionals are required to transport the missing items.	It is possible to deliver or pick up missing items easily.	Automated guided vehicle [A12]
	The input of additional human resources	It takes time to report to the physician and then put in additional support personnel in an emergency.	Prompt response in case of an emergency.	AI system capable of initial detection in case of an emergency [A13] Telecommunication technology [A8]
	Position change	The patient's position needs to be changed with limited human resources, and the discomfort caused by PPE consumes much physical strength. As many patients have poor lung conditions, the work intensity of changing the position is high when they are in the prone position.	Depending on the patient, necessary assistant personnel can be easily put in.	Wearable robot for reducing the burden on the musculoskeletal system [A14]
	Guardian consent for treatment and procedures	If consent for the procedure is obtained over the phone, the explanation of the healthcare professionals may be insufficient, or it may not be easy to secure time for decision-making on the procedure.		Using a video-conferencing system, reduces the anxiety of the family caregiver [A15] Help to understand with related procedure simulation using metaverse [A16]

Continued on the next page.

Table 2. Continued

	Classification	COVID-19	Usual care	Possible ICT solution[a]
Reduced tasks	Nurse handover	The procedure for two nurses to care for the patient together and check the concentration of the medication being administered is omitted. Being away from the patient during handover can make them take time to respond in an emergency. After the handover is completed, the nurses of the following duty will have greater work.	Inform the patient of the handover next to the patient. The patient's overall condition, the medication name and injection rate, and the intravenous injection site are checked. Various medical devices and injection site are assessed, and setting values are evaluated. Hand over the details to the nurse of the following duty while watching the EMR.	High-definition interactive video-conferencing system (e.g., telepresence) [A8]
	Physician rounds	The rounds are carried out outside the isolation room for the minimum number of people to enter the room. It is challenging to share treatment plans with nurses when only physicians enter the room. Alternatively, only nurses enter and perform the prescription from an external physician (e.g., change of medication rate, change of ventilator setting).	During the physician's rounds, the nurse is accompanied to discuss and communicate the patient's condition and treatment plan together.	Improvement of communication accuracy using electronic blackboard and Smart glass
	Nurse rounding	In order to reduce changing of clothes and entering and exiting the isolation room, the number of cases of responding to patients by phone outside the isolation room has increased.	If there is no urgent work when a patient calls, respond immediately face-to-face.	High-definition interactive video-conferencing system (e.g., telepresence) [A8,A17]
	Discharge education	It is impossible to inform the family caregiver regarding discharge education. There is a possibility of omission because discharge education, such as precautions after discharge and outpatient treatment, is provided to patients.	Face-to-face education is conducted using printed materials with family caregivers and patients.	To be able to participate in patient and family caregiver education regardless of the location of the family caregiver, through the high-definition interactive video-conferencing system (e.g., telepresence) and metaverse [A15,A18]
	Family caregiver visits and explanation of patient conditions	Due to the risk of infection, family caregiver visits are completly prohibited. This increases the anxiety and loneliness of patients and family caregivers. A number of institutions explain the patient's condition on the phone, but the satisfaction of family caregivers is low because the time is not accurately fixed.	When hospitalized, one family caregiver is accompanied, and visitation is according to the hospital's protocol.	High-definition interactive video-conferencing system (e.g., telepresence) [A18]

PPE: personal protective equipment, V/S: vital sign, EMR: Emergency Medical Record.

[a]The parentheses indicate a reference and the list is in Appendix 2.

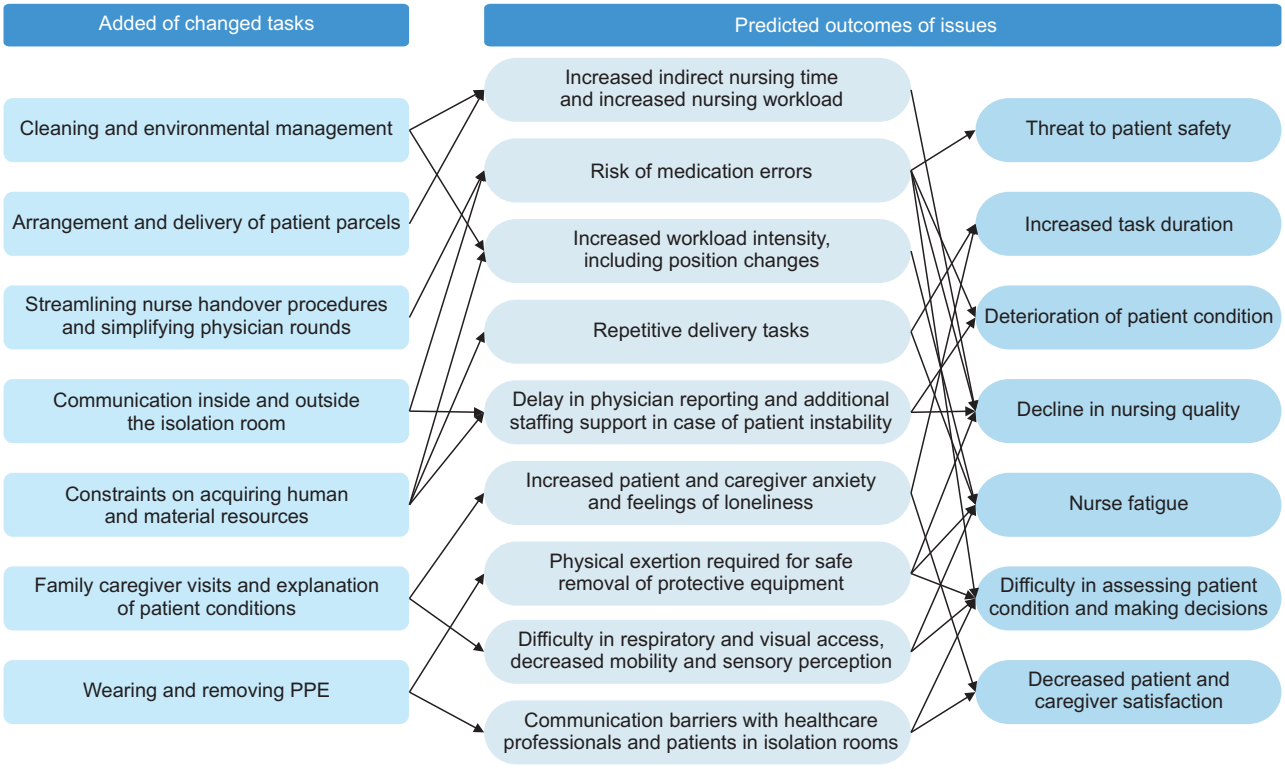

Figure 1. Changes in tasks during the COVID-19 pandemic. PPE: personal protective equipment.

must stay with patients throughout their shifts, they must endure the discomfort of wearing PPE for extended periods [19,20]. This can increase the risk of physical discomfort and pressure ulcers [21]. Furthermore, prolonged hospital stays can increase the risk of infection for healthcare professionals [20], which in turn can heighten nurses' anxiety levels. The isolation resulting from infection, or the departure of nursing staff due to heavy workloads, can lead to a decrease in available human resources [22]. This could potentially create a vicious cycle, resulting in a decline in the quality of nursing and medical care [23]. The implementation of advanced monitoring systems could help to reduce unnecessary exposure and optimize resource allocation [A7,A10]. For healthcare organizations, it is crucial to promote the adoption of integrated electronic health record systems. These systems facilitate seamless communication and information sharing among healthcare professionals [A11], enabling efficient coordination, timely updates, and collaborative decision-making in the management of COVID-19 cases.

A limited number of people are permitted to enter the isolation room, leading to additional responsibilities such as material transfer, waste disposal, post-patient discharge cleaning, and environmental management tasks. This increase in indirect nursing time escalates the workload, resulting in excessive stress [22]. The preparation for sample transfer has also expanded the nurse's duties, now encompassing sterilization and wrapping of the container after sample collection, such as a blood sample. Furthermore, with family caregivers prohibited from visiting, nurses have taken on the task of receiving, organizing, and delivering personal items necessary for the patient. This increase in repetitive and non-essential tasks may detract from crucial nursing interventions, such as patient assessment, position changes, oral care, and the opportunity for assessment during these processes [22]. The use of mobile robots for item transfer [A3,A4] or cleaning robots for environmental management can help reduce cross-infection among patients [A1,A2]. Moreover, these technologies can effectively lessen the workload of healthcare professionals [24]. It is crucial to actively seek and test innovative technologies that can efficiently eliminate repetitive and non-essential nursing tasks, thereby promoting increased efficiency and improved workflow. Further research is needed in this area to effectively identify and implement these technological solutions.

The results of this study show that the participants experienced challenges in communicating with healthcare professionals both inside and outside the isolation room, as well as with patients, due to their PPE. The quality of care within medical institutions and community treatment centers is significantly influenced by the communication between pa-

tients, nurses, and healthcare professionals [25]. To address these communication issues, the study participants offered insightful suggestions, proposing the potential application of existing commercially available devices such as electronic blackboards and smart glass to improve communication precision. However, it is crucial to acknowledge that there is a current dearth of research exploring the usability and effectiveness of these proposed solutions. As such, additional research is necessary to comprehensively examine the feasibility and potential advantages of implementing these technologies in healthcare environments.

The study participants identified communication inefficiencies not only among healthcare professionals but also during nursing information interviews, explanations of treatment and procedures to family caregivers, and the consent process at admission. These challenges occur when patients cannot be interviewed directly, and the statements of family caregivers become the primary sources of information. Moreover, obtaining consent via phone-based communication can impede the accurate conveyance of crucial details and restrict opportunities for in-depth discussions. The study overall highlights significant difficulties in accurately communicating hospitalization information and procedure consent due to the reliance on phone-based communication methods. Therefore, various commercial ICT solutions or software programs, such as artificial intelligence (AI) speakers, Bluetooth earphones, smartphone applications, and real-time video-conferencing programs used in fields outside of healthcare, could be considered to enhance communication quality and efficiency [26]. Additionally, it has been reported that several hospitals have attempted to use speech-to-text technology to convert voice information into text, thereby preventing information omission and improving record integrity. However, further research is required in this area [27]. Furthermore, the use of voice translation functions could potentially improve communication efficiency with foreign patients.

Given the prohibition on family caregiver visits, it becomes impossible to educate them on discharge procedures. This heightens the likelihood of omitting crucial discharge education, such as post-discharge precautions and outpatient treatment for patients. Consequently, this leads to increased anxiety among family caregivers and a decrease in their satisfaction. Therefore, the transition between inpatient and outpatient settings is a critical factor in improving patient outcomes [28]. In order to address the needs of family caregivers in relation to medical services, and to alleviate their psychological issues such as anxiety and stress caused by hospitalization and visitation restrictions, it is essential to explore the use of video visit systems [A15,A18]. Furthermore, video visits can be particularly effective in a pandemic situation as they reduce direct contact, and they are not constrained by time or location due to their virtual nature. From the perspective of healthcare professionals, video visits provide an opportunity to explain the patient's condition to caregivers and share a care plan, thereby reducing their workload [29].

It was also reported that essential tasks, which could influence patient treatment and nursing outcomes, have been reduced. Specifically, handovers and rounds conducted by various healthcare professionals are crucial nursing actions for maintaining care continuity [30]. However, due to the constraints of the isolation room, nurses are unable to enter to assess the patient's overall condition and evaluate the medication and injection site. Patient safety-focused nursing activities include patient education and identification, fall prevention, infection control, and prevention of medication errors [A19]. Consequently, a reduction in these activities could heighten the risk of medication errors and directly jeopardize patient safety. During rounds, only a limited number of individuals are permitted to enter the isolation room. This restriction hampers the sharing of treatment plans due to decreased communication among healthcare professionals. Moreover, in emergency situations, the response of additional personnel may be delayed, increasing the likelihood of the patient's condition worsening during this delay. Therefore, it is essential to employ "untact" (or "contactless") technologies such as telepresence systems, CCTV, and mobile robots that can easily monitor the condition of patients in the isolation room and facilitate communication with them [A5].

This study has some limitations. First, the results may diverge from previous studies due to the reliance on participants' memory when recording their activity diaries. As the analysis was based on the diaries of seven nurses, the generalizability of the findings across diverse medical institutions is limited. Second, despite the potential for variability in hospital policies regarding COVID-19, influenced by factors such as hospital size, environment, and geographical location, our study did not thoroughly evaluate the impact of these variations. Therefore, it is essential to replicate this study with a larger sample of healthcare professionals. Finally, it should be noted that the situation regarding COVID-19 has undergone significant changes since the data collection for this study, which may complicate the interpretation of the results.

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The COVID-19 pandemic has led to an increase in non-nursing duties due to a decrease in the number of people allowed in isolation rooms and a shortage of staff. This has made communication between patients, family caregivers, and healthcare professionals challenging. The additional workload has not only exhausted nurses but has also negatively impacted the quality of care. These findings underscore the importance of ICT support in addressing the challenges faced by nurses during the COVID-19 pandemic. By implementing targeted ICT interventions, we can lessen the burden on nurses, improve their work environment, and bolster the resilience of healthcare systems during national crises. Further research is required to confirm the effectiveness of the specific ICT solutions mentioned in this study and to identify innovative technologies that can reduce repetitive tasks for nurses. Healthcare organizations should consider adopting integrated electronic health record systems and exploring technologies such as telepresence systems and mobile robots. These tools can optimize communication and enhance patient safety in isolation rooms.

Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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Appendix 1. A structured activity diary used in the study

A Day in the Life of a General Ward Nurse for COVID-19 Patients

< Writing Guidelines >

- Please refer to the examples and then delete them before writing.
- If there are not enough rows, please add additional rows to complete the writing.
- Please record all nursing duties and activities, including nursing practice, breaks, meetings, and documentation, as detailed as possible.
- Please write down your recollection of the past 7 days of work.

Time	Tasks	Task duration (min)	Task difficulty[a]	Remarks[b]
(Example) 6:30–7:00	Patient assessment via Electronic Medical Records	30	3	Having a high patient load
(Example) 7:00–7:30	Handover	30	4	Difficulties in directly assessing the patient's condition as it takes place outside the isolation room.
(Example) 7:30–7:40	Putting on personal protective	10	4	-
(Example) 7:40	Entering the isolation room for nursing care	-	-	-

[a]Using a 5-point Likert scale: 1 (very easy), 2 (easy), 3 (moderate), 4 (difficult), and 5 (very difficult).

[b]Remarks provide comments on the reasons for the difficulty or ease.

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