Impact of Caring for COVID-19 Patients on Nurses' Distance Learning Progress

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Abstract

We sought to understand the impact of disruption of nurses' daily routines by COVID-19 on their participation in Continuing Professional Education. We analyzed learning logs of 194 nurses enrolled in a 12-month distance learning course, one cohort from March 2019 to February 2020, and one from March 2020 to February 2021, during the COVID-19 pandemic. Monthly login frequency was significantly higher in March 2020 than in March 2019, and significantly lower in April 2020 than in April 2019, which we associate with increased COVID-19 cases, hospitalizations, and deaths in April 2020. From March 2020 to August 2020, login frequency was significantly higher for nurses without previous distance learning experience, suggesting that their distance learning strategies were not yet established. During September and October 2020, login frequency was significantly higher, from which we infer previous procrastination. We found no significant differences between login frequencies of nurses who cared for COVID-19 patients and those who did not. The results of our study suggest that stressors imposed by the COVID-19 pandemic significantly hindered distance learning progress whether or not nurses directly cared for COVID-19 patients. Based on our findings, we recommend screening distance learning experiences and providing mentoring and learning support to mitigate interference with distance learning progress during times of heightened professional and personal stress.

Keywords: Distance Learning, Nurses, COVID-19, Continuing Professional Education

1 Introduction

The outbreak of the COVID-19 pandemic in 2020 and its persistence in 2021 have had a significant impact on the lives of many healthcare professionals, including extended work schedules, disrupted routines, altered practices, and restrictions on mobility and contact. All healthcare workers needed to be familiar with the revised COVID-19 patient care guidelines [1]. In addition, continuing professional education (CPE) was necessary acquire competencies in infection control [2], ventilator management [3], medication administration [4,5], and

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positioning [6].

While CPE for healthcare professionals had been conducted in person prior to COVID-19, the onset of the pandemic made it necessary to shift to distance learning, which requires different competencies [7] and greater self-regulation. A study of college students found that as students moved from in-person to distance learning, their ability to participate in the course decreased [8]. As the number of COVID-19 hospitalizations rose, healthcare providers needed to cope with the increased workload and stress caused by COVID-19-related care.

For nurses to continue CPE while performing their duties in situations where care for COVID-19 is required, it is especially important for educators to monitor the progress of learning and provide learning support. How often a learner participates in an online course is an important predictor of outcomes. In previous studies, login frequency was used to analyze course satisfaction [9] and grades [10,11]. Similarly, online activities of learners can be analyzed using login frequency to predict underachieving students at an early stage, providing an early warning for timely intervention [12, 13]. Using an unplanned experiment in distance learning, we investigated the impact of COVID-19 on nurses' distance learning behaviors by analyzing the frequency of their logins.

2   Methods

2.1   Study Design

A retrospective analysis of previously collected online CPE learning logs was conducted from March 2019 to February 2020 and from March 2020 to February 2021. A participant survey on involvement in care of COVID-19 patients was administered in March 2021.

2.2   Participants

The study population comprised 194 nurses who were trainees at Center A, an academic medical center. To be eligible to study at Center A, nurses needed to be employed by medical and educational institutions in Japan and have five or more years of nursing experience. All participants worked full-time.

The course in which trainees were enrolled consisted of 252 hours of specific medical training [14] delivered through self-paced distance learning over 12 months, commencing in March 2019 and 2020. The course content was the same for Group A (n = 109; March 2019–February 2020) and Group B (n = 85; March 2020–February 2021). All participants were confirmed to have completed the course.

The participants in Group B received a questionnaire that ascertained their involvement in COVID-19 patient care. Respondents were separated according to their experience with online learning using data previously collected at the time of admission and further grouped according to their involvement in COVID-19 patient care (Figure 1). In this study, the group of learners who answered the questionnaire and had distance learning experience was designated as Group C, and the group of learners who had no distance learning experience was designated as Group D. Group C and Group D were then divided into two groups according to whether or not they cared for COVID-19 patients ("Cared for COVID-19 patients" and "Did not care for COVID-19 patients").
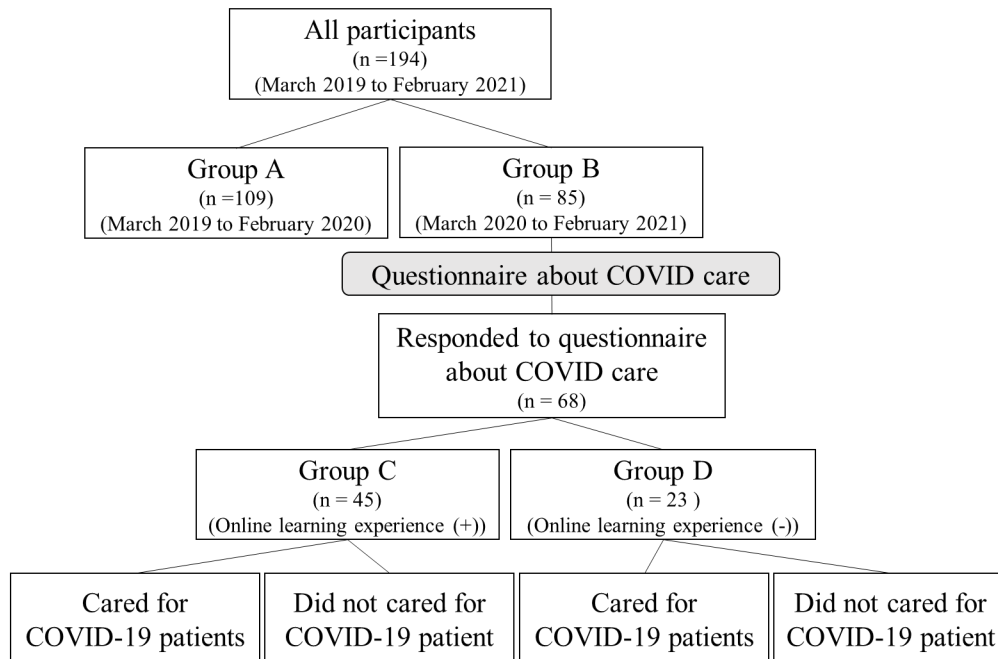
Figure 1: Participant groupings

2.3 Data Collection

Demographic data collected for each participant consisted of age, gender, years of nursing experience, academic background, and special qualifications. Login frequency data were downloaded retrospectively from the course Moodle server. Monthly login frequency was calculated as the mean of login events per participant per month. Login frequency, rather than login session length, was chosen as a better measure of participants' activity, as students often fail to log out when inactive on the learning management system.

A questionnaire was administered in March 2021 to determine whether the participants had provided direct care for COVID-19 patients. Those who cared for COVID-19 patients provided information on the level of care provided. The answer options were: 1) No, I have not directly cared for COVID patients, 2) Yes, my scheduled shift was changed to accommodate COVID-19, 3) Yes, I was involved in helping my ward/facility due to COVID-19, 4) Yes, I was involved in outpatient triage for COVID-19 patients, 5) Yes, I was involved in the direct care of COVID-19 patients in the ward (care of patients with mild disease), 6) Yes, I was involved in the direct care of COVID-19 patients on the wards (moderate care), and 7) Yes, I was involved in the direct care of COVID-19 patients in the ward (care of severely ill patients). The questionnaire included open-ended questions regarding difficulties engaging in distance learning while performing clinical duties, support needed to promote distance learning while performing clinical duties, and specific innovations and good practices that promote distance learning while performing clinical duties.

2.4 Data Analysis

The chi-squared test, Fisher's exact test, and independent t-test were performed on the demographic data. The Mann-Whitney U test and Spearman's rank correlation were used to

analyze the results, with the significance level set at 5%. IBM SPSS Statistics version 26.0 was used for statistical analysis. Open-ended questions were categorized and posted as written by the participants.

2.5 Ethical Considerations

The aim, purpose, methods, and duration of this study were explained to the prospective participants before obtaining their written consent. The prospective participants were advised that participation was voluntary, their privacy would be protected, and they would not be disadvantaged by declining to participate or withdrawing from the study. Approval from the Jichi Medical University Clinical Research Ethics Committee (approval number: 16-091) was obtained prior to the start of the study.

3   Results

Of Group B participants, 80% (n = 68) responded to a questionnaire on COVID-19 patient care. Of the respondents, 66% (n = 45) had experience with distance learning (Group C).

3.1 Demographic Characteristics

The average age of the subjects by group ranged from the late 30s to early 40s. There were more female participants (60.9;84.4%) than males. There were no significant differences in demographic characteristics between groups A and B. There were significant differences in the proportions of each gender in Groups C and D (Tables 1 and 2).

3.2 Comparison of Login Frequency per Month by Year

Analysis of login frequency by month for Group A (FY2019) and Group B (FY2020) revealed a significantly higher frequency in March for Group B ($p < .01$, $r = -0.32$). However, the reverse was true for April, where the login frequency was significantly higher in Group A ($p = .02$, $r = 0.18$; Table 3). There was a very weak positive correlation between login frequency in September and years of nursing experience ($r = .16$, $p = .031$). In addition, there was a very weak negative correlation between age and October ($r = -.14$, $p = .046$), age and November ($r = -.15$, $p = .042$), age and December ($r = -.18$, $p = .011$), age and January ($r = -.24$, $p = .00$), age and February ($r = -.14$, $p = .049$).

Table 1: Demographic characteristics (n = 194)

		Group A (n = 109)		Group B (n = 85)		*p*
		number	**%**	**number**	**%**	
Age						
mean ± SD (y)		41.7 ± 7.1		40.9 ± 6.8		.56
Gender						
	Female	86	78.9	61	71.8	.31
	Male	23	21.1	24	28.2	(*F*)
Work experience						
mean ± SD (y)		17.2 ± 6.8		16.1 ± 6.8		.78
Special qualifications **(certified nurse or certified nursing specialist)**						
	yes	41	37.6	58	68.2	.45 (*F*)
Academic background						
	Associate degree	68	62.4	47	55.3	
	Bachelor's degree (College)	14	12.8	6	7.0	.20
	Bachelor's degree (University)	22	20.2	27	31.8	
	Master's/Doctor's degree	5	4.6	5	5.9	

*p<0.05   (*F*)Fisher's exact test

Table 2: Demographic characteristics (n = 68)

		Group C (n = 45)		Group D (n = 23)		*p*
		number	**%**	**number**	**%**	
Age						
mean ± SD (y)		41.4 ± 7.0		38.6 ± 7.0		.70
Gender						
	Female	38	84.4	14	60.9	.04
	Male	7	15.6	9	39.1	(*F*)*
Work experience						
mean ± SD (y)		17.0 ± 6.5		13.4 ± 6.5		.61
Special qualifications **(Certified nurse or certified nursing specialist)**						
	yes	7	15.6	9	39.1	.79 (*F*)
Academic background						
	Associate degree	27	60.0	11	47.8	
	Bachelor's degree (College)	4	8.9	0	0.0	.16
	Bachelor's degree (University)	11	24.4	11	47.8	
	Master's/Doctor's degree	3	6.7	1	4.4	

*p < 0.05   (*F*)Fisher's exact test

Table 3: Comparison of login frequency per month by year (n = 194)

	Mean		p	r
	Group A (2019-2020)	Group B (2020-2021)		
March	31.51	55.39	<.01	-0.32
April	75.32	74.62	.02	0.18
May	48.74	38.18	.95	0.01
June	45.81	36.46	.45	0.05
July	52.05	19.54	.78	0.02
August	25.95	18.27	.17	0.10
September	31.72	23.58	.44	-0.06
October	95.84	41.21	.53	0.05
November	48.65	31.94	.99	0.00
December	39.61	32.95	.22	0.09
January	36.28	35.33	.55	0.04
February	27.69	17.29	.73	0.03

3.3 Comparison by Online Learning Experience

From March 2020 to August 2020 and from December 2020 to February 2021, the login frequency was significantly higher in Group D (no online learning experience) than Group C (online learning experience). In contrast, in September and October 2020, the login frequency was significantly higher in Group C (Table 4). There was no correlation between any of the variables.

3.4 Influence of Care for COVID-19 Patients on Distance Learning

Figure 2 shows the level of care provided to COVID-19 patients by month. The number of participants who provided care to COVID-19 patients increased from April to June 2020 and from November 2020 to February 2021. The number of participants who provided care to moderately or severely ill patients increased in April and May 2020 and from December 2020 to January 2021.

There was no significant difference in login frequency according to the level of COVID-19 patient care (Table 5). For the group with prior distance learning experience (Group C), there was no significant difference in login frequency according to the level of care for COVID-19 patients in any month (Table 6). However, for participants with no distance learning experience (Group D), the login frequency for participants who cared for COVID-19 patients was significantly lower than the login frequency for participants who did not care for COVID-19 patients in April 2020 (p = .02, r = -0.48), May 2020 (p = .03, r = -0.56), and June 2020 (p = .03, r = -0.45; Table 7). There was no correlation between any of the variables.

Table 4: Comparison of login frequency per month by distance learning experience (n = 68)

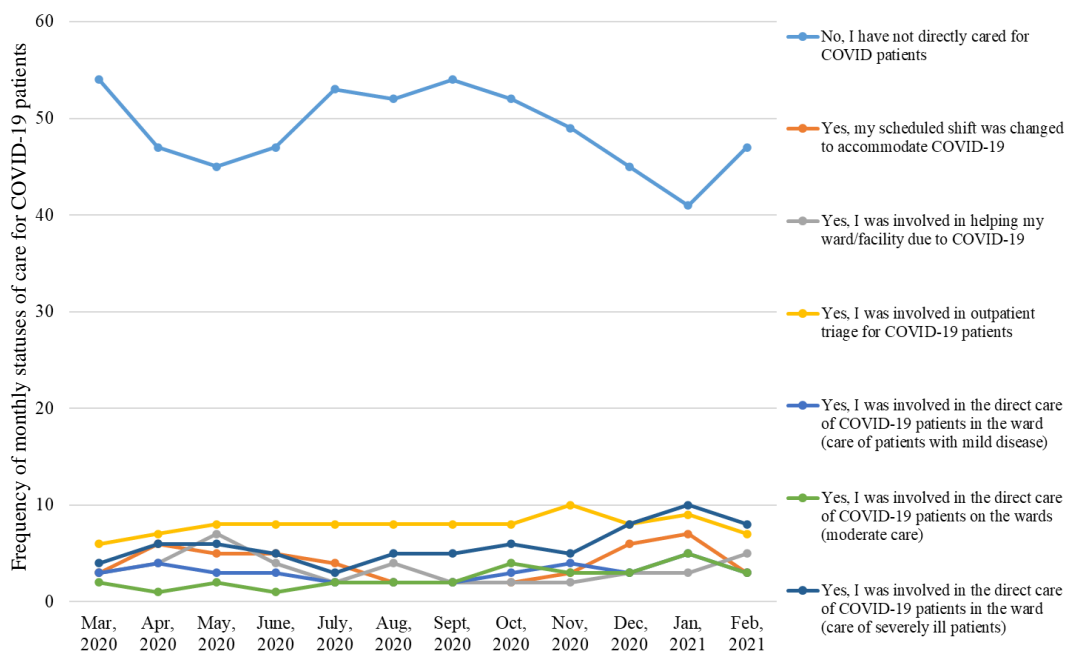| | Mean | | | |
	Group C (Online learning experience (+))	Group D (Online learning experience (-))	*p*	*r*
Mar, 2020	45.33	88.65	<.01	-0.46
Apr, 2020	24.87	175.39	<.01	-0.79
May, 2020	8.87	101.43	<.01	-0.81
June, 2020	8.91	98.30	<.01	-0.80
July, 2020	10.98	37.22	<.01	-0.64
Aug, 2020	12.38	34.48	<.01	-0.49
Sept, 2020	28.47	22.22	.03	-0.27
Oct, 2020	57.80	22.00	<.01	-0.56
Nov, 2020	31.27	38.96	.88	-0.21
Dec, 2020	22.44	62.26	<.01	-0.66
Jan, 2021	15.64	83.70	<.01	-0.78
Feb, 2021	15.33	27.48	.01	-0.34

Figure 2: Monthly status of care for COVID-19 patients

Table 5: Comparison of login frequency by month according to COVID-19 patient care status (N = 68)

	Cared for COVID-19 patients		Did not care for COVID-19 patient		*p*	*r*
	n	Mean	n	Mean		
Mar, 2020	14	64.36	54	58.85	.35	-0.11
Apr, 2020	21	66.67	47	79.85	.63	-0.06
May, 2020	23	34.48	45	43.09	.62	0.00
June, 2020	21	34.38	47	41.28	.98	0.00
July, 2020	15	21.40	53	14.40	.44	-0.09
Aug, 2020	16	20.44	52	19.67	.58	-0.07
Sept, 2020	14	27.07	54	26.17	.39	-0.11
Oct, 2020	16	42.38	52	46.71	.80	-0.03
Nov, 2020	19	35.74	49	33.14	.70	-0.05
Dec, 2020	23	33.30	45	37.24	.61	-0.06
Jan, 2021	27	28.96	41	45.78	.10	-0.20
Feb, 2021	21	15.00	47	21.43	.22	-0.15

Table 6: Comparison of login frequency by month according to COVID-19 patient care status (N = 45)

	Cared for COVID-19 patients		Did not care for COVID-19 patient		*p*	*r*
	n	Mean	n	Mean		
Mar, 2020	10	54.50	35	42.71	.26	-0.17
Apr, 2020	13	28.85	32	23.25	.32	-0.15
May, 2020	13	10.00	32	8.41	.80	-0.04
June, 2020	12	4.00	33	10.70	.49	-0.10
July, 2020	11	9.45	34	11.47	.76	-0.05
Aug, 2020	11	9.36	34	13.35	.44	-0.11
Sept, 2020	10	28.50	35	28.46	.63	-0.07
Oct, 2020	11	51.45	34	59.85	.48	-0.10
Nov, 2020	13	31.46	32	31.19	.83	-0.03
Dec, 2020	16	21.56	29	22.93	.97	-0.01
Jan, 2021	21	13.85	24	17.13	.57	-0.09
Feb, 2021	16	14.50	29	15.79	.97	-0.01

Table 7: Comparison of login frequency per month by distance learning experience (n = 23)

	Cared for COVID-19 patients		Did not care for COVID-19 patient		p	r
	n	Mean	n	Mean		
Mar, 2020	4	89.00	19	88.58	.91	0.19
Apr, 2020	8	128.13	15	200.60	.02	-0.48
May, 2020	10	66.30	13	128.46	.01	-0.56
June, 2020	9	74.89	14	113.36	.03	-0.45
July, 2020	4	28.00	19	39.16	.67	-0.09
Aug, 2020	5	44.80	18	31.61	.54	0.13
Sept, 2020	4	23.50	19	21.95	.67	0.09
Oct, 2020	5	22.40	18	21.89	.64	0.10
Nov, 2020	6	45.00	17	36.82	.29	0.23
Dec, 2020	7	60.14	16	63.19	.97	-0.01
Jan, 2021	7	72.14	16	88.75	.14	-0.32
Feb, 2021	5	16.60	18	30.50	.06	-0.40

3.5 Analysis of Open-ended Questions

Of the participants, 60.3% (n = 41) reported difficulties engaging in distance learning while performing clinical duties. Twenty participants answered that balancing clinical duties was an issue, e.g., "I was mentally and physically exhausted from working in the COVID ward, and sometimes found it difficult to find time to study after work." Time management was mentioned by 12 participants, such as "It was difficult to find the time." Excessive fatigue was mentioned by five participants, e.g., "I had to continue my studies without time to recover from daily fatigue." Maintaining motivation to learn was mentioned by two participants, e.g., "I sometimes felt it was difficult to maintain motivation." Balancing time with family was mentioned by two participants, such as "I neglected housework and childcare and caused trouble to my family." Securing a place to study was mentioned by two participants, e.g., "I need to secure a place where I can use a computer."

Regarding necessary support, 66.2% (n = 45) of the participants needed to learn online. Twelve participants needed help to secure study time and space. A specific statement was "I want an external approach to secure my own study time." Eleven participants stated a contact point where they could consult casually would be helpful. In addition, 11 participants suggested having a contact person they could ask for help, and that being able to exchange information with other learners would enable them to proceed without needing to ask a teacher for help. Learners desired more communication between themselves and with teachers, and more tutoring. Five participants wanted to learn progress management and eight wanted support when adjusting work schedules.

The participants' recommendations for implementing distance learning included "securing study time," "explanations of distance learning in the workplace," "devising study methods," "securing study locations," and "communication among learners."

4 Discussion

We compared the monthly login frequencies of two cohorts (FY2019 and FY2020) for a self-paced distance learning course. The login frequency of the FY2020 cohort was higher in March, while the login frequency of the FY2019 cohort was higher in all other months. Login frequency was higher in most months for learners who had no prior distance learning experience. In the group with distance learning experience, caring for COVID-19 patients did not affect login frequency. In the group with the distance learning experience, care for COVID-19 patients had no effect on login frequency, while in the group without distance learning experience, the presence or absence of caring for COVID-19 patients affected login frequency.

4.1 Impact of the Number of COVID-19 Infected People on Learning Progress

As shown in Figure 3, the number of new cases of COVID-19 in Japan increased after April 2020, August 2020, and November 2020, reaching approximately. 8,000 in January 2021 [15]. Learner login frequency was lower in April 2020 than in April 2019 (Table 3). The number of logins from April to June was significantly lower for participants without prior distance learning experience who cared for COVID-19 patients (Table 7). This suggests that during the first wave of COVID-19 from April 2020 until COVID-19 hospitalizations decreased, some participants were not able to log into the course. In their responses to the open-ended questions, participants remarked on the difficulty of balancing working in the COVID-19 ward with distance learning. From these findings, we infer that implementation of COVID-19 patient care in hospitals and pandemic-imposed restrictions on healthcare workers' behaviors made studying more difficult and decreased their motivation to learn due to physical and mental fatigue [16]. For adult learners, it is important to provide learning support that emphasizes learner autonomy [17]. However, it has been noted that many adults have not acquired the skills needed for autonomous learning and the ability to reflect on their learning [18].

In unforeseen situations, such as the COVID-19 pandemic, it is difficult for learners to exercise their autonomy. It is not possible to solve the problem at the discretion of the individual learner. Rather, it is necessary for educational institutions to actively intervene and support learners so that they do not drop out. Our study demonstrates the efficacy of investigating and analyzing learners' work situations and CPE learning logs at an early stage. Based on our results, it we recommend specific support for CPE be provided while learners are performing their clinical duties, such as encouraging medical institutions to ensure adequate CPE learning time and to prepare documents that describe the time required and expectations for distance learning.
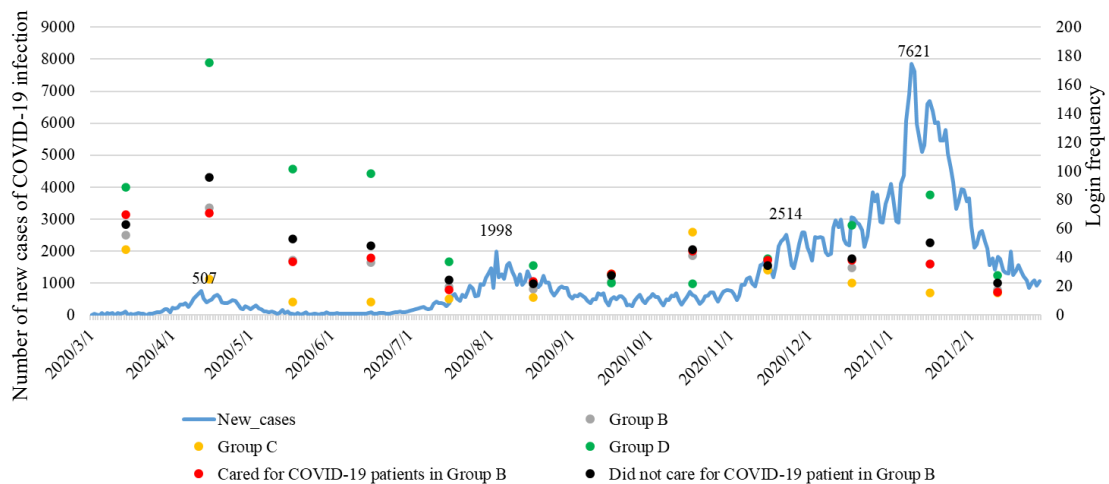
Figure 3: Number of new cases of COVID-19 infection, new deaths, and login frequency

4.2 Distance Learning Experience and the Impact of COVID-19

Previous research by the authors has shown that nurses' prior distance learning experience does not affect learning progress or performance [13]. However, the results of the current study showed that COVID-19 patient care reduced course login frequency in the group with no distance learning experience. In April and May 2020, when the number of COVID-19 patients increased, learners who cared for such patients logged in at a lower rate. In June, when the number of patients decreased, the number of logins remained low. The reason for the low number of logins in June may be that COVID patients require more than two weeks of recuperation before they can be discharged from the hospital, and patient care may have been affected in June. In contrast, the number of logins of learners who cared for COVID-19 patients increased after August 2020. The number of COVID-19 patients increased again in August and December. As shown in Figure 2, the number of moderately or severely ill patients also increased in December. It can be inferred from the data that learners were able to continue distance learning while caring for COVID-19 patients, suggesting it takes approximately six months to adapt to distance learning, even under severe conditions.

   Caring for COVID-19 patients imposed a significant burden beyond nurses' normal workloads and usual best practices of care. Under stressful situations, such as those imposed by the COVID-19 pandemic, the usual support provided learners with no prior distance learning experience may be inadequate. Compared to the previous year, learners without prior distance learning experience had a higher login frequency as they adapted to a new learning process and proceeded cautiously at the beginning. However, learners without prior distance learning experience who had to simultaneously cope with COVID-19 and a new way of learning may not have been able to concentrate sufficiently on learning to self-regulate. In contrast, the number of logins of learners with distance learning experience increased from September to October 2020, when the number of COVID-19 patients decreased. It can be inferred from the data that these learners were able to self-adjust to distance learning through their prior experience and actively delay [19] their learning by self-assessing and balancing priorities of learning and work.

4.3 Limitations

The small number of participants may contribute to the small effect sizes observed. Login frequency is not necessarily an indicator of active learning, as a learner may be logged in, but inactive. Future studies would benefit from measuring login frequency against knowledge acquisition and the pace of progress through the course. In addition, the number of participants was too small to analyze the effects of different levels of care on login frequency referenced against the COVID-19 patient caseload. To better understand the mechanisms through which exhausted medical professionals can continue to learn amid the ongoing stressors of the COVID-19 pandemic, we plan to conduct surveys and consider specific learning supports applicable to distance learning.

5   Conclusions

In this study, we investigated the impact of COVID-19 care on CPE by assessing distance learning in situations that require time for organizational response. We found that learners who cared for COVID-19 patients had a relatively low number of logins. Learning (as indicated by login frequency) declined when learners who had no prior experience in distance learning were engaged in COVID-19 patient care. By contrast, even though they were caring for COVID-19 patients, after approximately six months of the distance learning experience, such participants were able to adapt to and manage their distance learning.

The results of this study indicate the need for educational institutions to understand the current situation and actively intervene so that learners who are engaged in CPE and coping with COVID-19 or analogous stressor can balance their studies and work. In addition, when learners who have no experience in distance learning are forced to cope with COVID-19, it is assumed that it will be difficult for them to continue CPE, and an extension of the study period may be beneficial. At the same time, it is important to check not only login frequency but also login time and to evaluate whether sufficient learning time can be secured.

Acknowledgment

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