INTRODUCTION

In March 2020, after the first Coronavirus disease 2019 (COVID-19) outbreak in China in December 2019, the World Health Organization declared a pandemic. Since January 2020, when the first confirmed case was reported, 17,237,878 cumulative confirmed cases had occurred in South Korea by April 30, 2022 [1]. Although vaccine development, national social distancing recommendations, and quarantine guidelines had been applied [2], COVID-19 continued to spread worldwide due to easily transmitted virus mutations. Prolonged COVID-19 infections pose a significant threat to society as a whole. When a new infectious disease such as COVID-19 occurs, people use various online media to obtain related knowledge and preventive action information [3]. However, COVID-19 infections are prolonged, and related news is continuously reported; moreover, false and uncertain information has emerged that increases people’s anxiety [4,5]. A previous study showed unclear information and negative attitudes toward infectious diseases such as COVID-19, leading to distress and panic [6].

In particular, although college students in early adulthood are still forming healthy habits [7], from the point of view of preventive medicine, there is a lack of interest owing to their relatively good health [8]. However, also, college students experience depression and anxiety from news related to COVID-19 by the media [9]. Therefore, a need is emerging to strengthen quarantine management of COVID-19 for people in their early 20s [7]. The knowledge and optimistic attitude about COVID-19 lead to good preventive practices [6]. Nursing students are particularly interested in public health through clinical practice in hospitals and communities [10], but they are also in their early 20s. Therefore, it is neces-
sary to understand their knowledge, attitudes, anxieties, and preventive behaviors regarding COVID-19.

The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) outbreak changed our lives, especially in education. Many colleges and universities need help maintaining face-to-face teaching. This situation has made them innovate and implement alternative educational strategies [11]. Besides this unprecedented educational crisis, faculty members have tried to provide learning opportunities like before COVID-19. So they have developed lots of E-learning classes [12,13]. Of course, nursing students and faculty members did their best in their school and clinical site circumstances. However, despite these efforts, due to COVID-19 and fewer learning opportunities at the clinical site, nursing students felt lost in their way. They even had fundamental doubts about their choice to become a nurse [13]. A review study of knowledge, attitude, and practice among healthcare workers, medical students, and nursing students during the COVID-19 pandemic suggested that a high level of knowledge, positive attitudes, and good preventive practices are held [6]. However, anxiety and fear of COVID-19 levels were high among nursing students in Turkey [14]. With the resumption of clinical practice, suspended at a time when there were still many COVID-19 patients, nursing students fear participating in clinical practice. However, influencing factors associated with nursing students’ anxiety exposure in clinical settings are relatively lacking. Therefore, this study attempted to investigate the relationship between knowledge, attitudes, preventive practices, and the anxiety of nursing students in clinical practice during the COVID-19 pandemic.

METHODS

Study design

This is a cross-sectional, descriptive study to determine the influencing factors of nursing students’ anxiety in participating in clinical practices during the COVID-19 pandemic.

Setting and samples

A total of 203 junior and senior nursing students participating in clinical practice education at three universities in Daegu city, South Korea, responded to an online survey. The reason why the subjects of the study were limited to nursing students in Daegu was that it was one of the cities with the largest number of COVID-19 patients in 2020, and the clinical practice began to resume in the second semester of 2020 partially. In addition, among nursing universities in Daegu, nursing students from universities that resumed clinical practice were selected as subjects of the study. Therefore, data were collected from March to April 2021. Among them, 172 questionnaires were analyzed for this study after 31 with missing data were excluded.

Instruments

Knowledge

Knowledge, attitude, and practice (KAP) refer to information on what is known, believed, and done by a specific population [6]. The knowledge portion of the questionnaire was developed by Jang et al. [15] to measure respondents’ knowledge about COVID-19. This instrument consisted of 10 items, scoring one point for correct answers about disease onset (i.e., COVID-19 is a respiratory infectious disease caused by a coronavirus), four items about symptoms (e.g., fever, cough, sore throat, muscle pain, and shortness of breath are possible symptoms), three items on disease transmission (e.g., using face masks can help prevent disease transmission), and two items about prevention (e.g., if soap and water are not available, use a hand sanitizer that contains at least 60% alcohol). The maximum possible score was 10 points; the higher the score, the higher the level of knowledge.

Attitude

Attitudes toward the COVID-19 pandemic were measured using a scale also developed by Jang et al. [15]. It consisted of two items for beliefs about overcoming a COVID-19 infection (e.g., confidence in winning the battle against COVID-19), two items on the importance of following directions (e.g., carefully reading and following instructions from the government), and one item (Do you agree that COVID-19 is a very dangerous contagious disease?) on the perceived severity of the infection. Each item was rated on a five-point Likert scale ranging from 1 (Not at All) to 5 (Absolutely). The Cronbach’s α coefficient was 0.72 in a previous study [15], and in this study, Cronbach’s α was 0.53.

Preventive practices

Another scale developed by Jang et al. [15], based on Centers for Disease Control and Prevention guidelines, was used to assess preventive practices by nursing students. It measured COVID-19 preventive behavior during the previous two weeks and was based on ten items. Each item
was rated on a four-point Likert scale from 0 (Not Performed) to 3 (Performed all the time). Reliability based on Cronbach’s α coefficient was 0.86 at the time of development, and in this study, Cronbach’s α was 0.77.

**Anxiety**

The Hospital Anxiety Depression Scale for Anxiety (HADS-A) was developed by Zigmond and Snaith [16] to measure such symptoms. HADS-A consists of seven items, each item ranging from 0 to 3. A total score of more than eight points out of 21 (the maximum possible) indicates considerable anxiety. The mean Cronbach’s α coefficient was 0.83 in 747 literature reviews [17], and Cronbach’s α was 0.69 in this study.

**Data collection**

Data were collected with an online survey through the nursing departments of three universities in South Korea, which was conducted from March 29 to April 12, 2021. A link to the questionnaire was presented, along with a notice about the study’s purpose and an explanation of the recruitment of students participating in a practical class. It took about 15 minutes to complete the questionnaire.

**Data analysis**

The final 172 responses were analyzed using SPSS 28.0 (IBM Corp., Armonk, NY, USA), with statistical significance (p-value) at less than 0.05. First, descriptive statistics of the general characteristics and variables represented frequency as a percentage and the mean with standard deviation. Preventive practices and anxiety according to the general characteristics were analyzed via Pearson’s correlation coefficient and independent t-test. Pearson’s correlation coefficient was used to determine correlations among knowledge, attitudes, preventive practices, and anxiety. Finally, to determine influences on anxiety, a multiple linear regression analysis was conducted. There were no autocorrelations among the variables, with the Durbin-Watson statistic ranging from 1.92 to 2.04, and there was no problem over multicollinearity, with a variance inflation factor ranging from 1.02 to 1.44.

**Ethical considerations**

This study gained the approval of the Institutional Review Board (IRB) of University of Ulsan in South Korea (IRB No.: 1040968-A-2020-011), which verified ethical processes and the protection of respondents’ rights. All data collection was conducted after approval, and only subjects who voluntarily wanted to participate in the study responded to the survey through the link. Before starting the online survey, the purpose, method, and assurances of confidentiality in the research were described. In addition, participants were informed that they could withdraw any time they wanted without consequence. After checking ‘I agreed’ if the subject agreed to participate in the study, they proceeded to the questionnaire. The study subjects did not include minors.

**RESULTS**

**Anxiety according to general characteristics**

There were no statistically significant differences in anxiety according to age (r = -0.06, p = 0.460), grade (t = 1.07, p = 0.288), isolation experience (t = -0.71, p = 0.479) except gender (t = -4.42, p < 0.001) (Table 1).

**Levels of knowledge, attitudes, preventive practices and anxiety**

The average total score for knowledge was 8.21 ± 1.10 out of 10 points. The mean attitude score was 4.22 ± 0.36 out of 5, the preventive practice was 2.28 ± 0.41 out of 3, and anxiety was 7.67 ± 3.20 out of 21 (Table 2).

### Table 1. Preventive practice and anxiety according to the general characteristics (n=172)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Categories</th>
<th>Mean ± SD or n (%)</th>
<th>Anxiety Mean ± SD</th>
<th>r or t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (y)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>152 (88.4)</td>
<td>22.02 ± 3.32</td>
<td>-0.06</td>
<td>0.460</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>20 (11.6)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grade</td>
<td>Junior</td>
<td>59 (34.3)</td>
<td>8.03 ± 3.06</td>
<td>-4.42</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td></td>
<td>Senior</td>
<td>113 (65.7)</td>
<td></td>
<td>1.07</td>
<td>0.288</td>
</tr>
<tr>
<td>Isolation experience</td>
<td>Yes</td>
<td>38 (22.1)</td>
<td>8.00 ± 3.02</td>
<td>-0.71</td>
<td>0.479</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>134 (77.9)</td>
<td></td>
<td>7.58 ± 3.25</td>
<td></td>
</tr>
</tbody>
</table>

SD, standard deviation.
and 24 subjects (15.0%) showed moderate to severe anxiety. That was lower than the 55.9% from GAD-7 in nursing students in Israel [18] and higher than the 5.5% from the BAI of midwifery students in Turkey [19]. In general, the anxiety level of nursing students is reportedly higher than college students in other departments [19]. In particular, nursing students experience more significant anxiety in clinical practice than during lectures [20,21]. Although there is no study on the relationship between anxiety and nursing intention, in previous studies during the MERS epidemic, high stress lowered future intentions to care for patients with infectious diseases [19]. Therefore, anxiety, negative emotion in nursing students, should be carefully monitored, and it was found to be a significant, influential factor.

Second, gender significantly affected anxiety; anxiety was exceptionally high in female nursing students compared to male students, similar to previous studies [19,14,22]. This is the same as the lower anxiety score in men compared to women [19]. However, this study’s results should be interpreted carefully because there were only 20 males (11.6%). Also, being female predicted a fear of COVID-19 [14,23]. Nursing students face anxiety for various reasons, such as economic uncertainty, fear of infection, and difficulties in education [19,24]. In this study, concerns about COVID-19 infection are believed to have played a major role in anxiety because the subjects are nursing students participating in clinical practice during the COVID-19 pandemic. Therefore, nursing educators should continuously contact, encourage, and support students, suggesting various coping strategies.

Also, a negative attitude toward COVID-19 was an influencing factor that increased anxiety. In addition, this study found that a higher anxiety level was significantly associated with negative attitudes toward COVID-

### DISCUSSION

This study attempted to understand the anxiety of nursing college students participating in clinical practice during the pandemic of infectious diseases. Clinical practice is essential in the education curriculum for nursing students because they are future healthcare workers. However, nursing students are at greater risk of infection in clinical practice, just like hospital staff. Therefore, assessing their knowledge, attitudes, preventive practices, and psychological anxiety over COVID-19 to provide appropriate education and support and ensure safe clinical practices.

As a result of this study, the average score for anxiety was 7.67 ± 3.20.

### Factors influencing anxiety

- **Age**: 0.07, t = 0.63, p = 0.533
- **Gender (ref: male)**: 0.73, t = 4.54, p < 0.001
- **Grade (ref: junior)**: 0.51, t = -0.05, p = 0.554
- **Isolation experience (ref: yes)**: 0.57, t = 0.88, p = 0.382
- **Knowledge**: 0.21, t = 0.97, p = 0.334
- **Attitude**: 0.14, t = -2.24, p = 0.026
- **Preventive practice**: 0.06, t = -1.20, p = 0.232

R² = 0.16, F = 4.45, p ≤ 0.001

### Correlations among knowledge, attitudes, preventive practices, and anxiety

Knowledge showed no statistical significance in any of the variables. However, preventive practices showed statistically significant positive correlations with attitude (r = 0.34, p < 0.001) and negative correlations with anxiety (r = -0.16, p = 0.036). On the other hand, anxiety has significantly negative correlations with attitude (r = -0.16, p = 0.037) (Table 3).

### Table 2. Levels of knowledge, attitude, preventive practice, and anxiety for COVID-19 (n=172)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean ± SD</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge</td>
<td>8.21 ± 1.10</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>Attitude</td>
<td>4.22 ± 0.36</td>
<td>3.2</td>
<td>5</td>
</tr>
<tr>
<td>Preventive practice</td>
<td>2.28 ± 0.41</td>
<td>1.2</td>
<td>3</td>
</tr>
<tr>
<td>Anxiety</td>
<td>7.67 ± 3.20</td>
<td>0</td>
<td>16</td>
</tr>
</tbody>
</table>

SD, standard deviation.

### Table 3. Correlation among variables (n=172)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Knowledge</th>
<th>Attitude</th>
<th>Preventive practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge</td>
<td>0.15 (0.840)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attitude</td>
<td>0.07 (0.370)</td>
<td>0.34 (&lt; 0.001)*</td>
<td></td>
</tr>
<tr>
<td>Preventive practice</td>
<td>0.08 (0.330)</td>
<td>-0.16 (0.037)*</td>
<td>-0.16 (0.036)</td>
</tr>
</tbody>
</table>

### Table 4. Factors influencing anxiety (n=172)

<table>
<thead>
<tr>
<th>Variables</th>
<th>SE</th>
<th>β</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Constant)</td>
<td>3.50</td>
<td></td>
<td>2.93</td>
<td>0.004</td>
</tr>
<tr>
<td>Age</td>
<td>0.07</td>
<td>0.05</td>
<td>0.63</td>
<td>0.533</td>
</tr>
<tr>
<td>Gender (ref: male)</td>
<td>0.73</td>
<td>0.33</td>
<td>4.54</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Grade (ref: junior)</td>
<td>0.51</td>
<td>-0.05</td>
<td>-0.59</td>
<td>0.554</td>
</tr>
<tr>
<td>Isolation experience (ref: yes)</td>
<td>0.57</td>
<td>0.07</td>
<td>0.88</td>
<td>0.382</td>
</tr>
<tr>
<td>Knowledge</td>
<td>0.21</td>
<td>0.07</td>
<td>0.97</td>
<td>0.334</td>
</tr>
<tr>
<td>Attitude</td>
<td>0.14</td>
<td>-0.18</td>
<td>-2.24</td>
<td>0.026</td>
</tr>
<tr>
<td>Preventive practice</td>
<td>0.06</td>
<td>-0.09</td>
<td>-1.20</td>
<td>0.232</td>
</tr>
</tbody>
</table>

SE, standard error; ref, reference.
19 and lower preventive behaviors, but it did not correlate with knowledge. In contrast, a high level of knowledge is significantly correlated with positive attitudes and practices [25]. In this study, the average knowledge score was 8.21 ± 1.10 out of 10, similar to the results of studies of nursing students in Saudi Arabia (82.1%) and Australia (82.9%). However, the instrumentations used were different [26]. It is thought that most of the subjects in this study had a high level of knowledge owing to access to related information through various resources, such as social networks and guidelines. In addition, the significant relationship between anxiety and attitude toward COVID-19 is similar to that of Alrubaiee [27]. Higher perceived susceptibility and severity affected anxiety [28], but a positive perception and attitude toward the disease can act as a factor that decreases anxiety. Therefore, organizing knowledge and focusing on positive attitudes toward preventive practices is more effective when training nursing students in clinical situations. It is also necessary to provide education that can reduce anxiety.

Nevertheless, this study has some limitations. First, it is limited to generalize results because the data in this study were collected from three different universities in one specific region. Second, there is a possibility that the responses were incorrect (compared with face-to-face surveys) because the data were collected online. Third, verifying reliability and validity through repeated studies is necessary because of the tool developed for use.

CONCLUSION

This study attempted to determine the effects of knowledge, attitudes, and preventive practices on anxiety in nursing students in clinical practice during the current pandemic. As a result, attitudes, preventive practices, and anxiety were found to be significantly correlated, regardless of knowledge levels. In addition, gender and attitude were found to be significant influencing factors in anxiety. Despite vaccinations, COVID-19 continues to spread due to its many variants. When COVID-19 infection is still prolonged, the results of this study can be used to develop nursing interventions that reduce anxiety among nursing students.

REFERENCES


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Sangjin Ko  https://orcid.org/0000-0003-2014-838X

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 국문초록
코로나바이러스감염증-19 대유행 중 임상실습에 참여하는 간호대학생의 불안에 미치는 영향요인
장군자1, 박선형2, 고상진3
1 대구대학교 간호학과 교수, 2 경일대학교 간호학과 교수, 3 울산대학교 간호학과 교수

방법: 본 연구는 COVID-19에 대한 지식, 태도, 예방행위가 불안에 미치는 영향을 파악하기 위한 횡단면 조사연구이며, 172명의 간호대학생을 대상으로 온라인 설문조사를 실시하였다. 수집된 자료는 SPSS 28.0 프로그램을 사용하여 기술통계, 상관분석 및 독립 t-검정 및 선형회귀분석을 실시하였다.
결과: 예방행위는 태도와 유의미한 양의 상관관계가 있었으며(t = 0.34, p ≤ 0.001), 불안은 태도(t = -0.16, p = 0.037), 예방행위(t = -0.16, p = 0.036)의 음의 상관관계를 나타내었다. 회귀분석 결과, 성별(β = 0.33, p < 0.001)과 태도(β = -0.18, p = 0.026)가 유의미한 영향요인이었으며, 설명력은 16%이었다(F = 4.45, p ≤ 0.001).
결론: 본 연구결과를 토대로 임상실습에 참여하는 간호대학생들의 불안을 줄이고, 예방행위를 증진시키는 중재 개발이 필요하다.

주제어: COVID-19, 지식, 태도, 예방행위, 불안