Medical students’ professionalism attributes, knowledge, practices, and attitudes toward COVID-19 and attitudes toward care provision during pandemic amidst the COVID-19 outbreak according to their demographics and mental health

Eun Kyung Choi¹ and Sanghee Yeo¹,²

¹Department of Medical Humanities and Medical Education, School of Medicine, Kyungpook National University and ²Kyungpook National University Hospital, Daegu, Korea

Purpose: This study examines various aspects related to medical professionalism in medical students during coronavirus disease 2019 (COVID-19) pandemic, focusing on their medical professionalism attributes, KPA (knowledge, practices, and attitudes) toward COVID-19 and attitudes toward provision of care in pandemic. We assessed whether these aspects related to medical professionalism were varied by their demographics and mental health level.

Methods: Six questionnaires related to medical professionalism were distributed online to medical students in six grades at a single medical school. A one-way analysis of variance was used to examine differences in scores related to medical professionalism based on their demographics, for example, gender, grade, residence, religion, as well as their mental health levels. Pearson correlation analysis was used to examine correlations between each variable.

Results: Female students scored higher on medical professionalism attributes and attitudes toward duty-to-care than male students. Medical professionalism attribute scores were higher with higher relationship satisfaction and resilience levels but lower with higher anxiety levels. Furthermore, these scores were significantly associated with attitudes toward COVID-19 preparedness. However, COVID-19 knowledge and practice scores were negatively associated with attitudes toward COVID-19 preparedness and careers after graduation. Meanwhile, students who took the leave of absence related to 2020 doctors’ strike had significantly lower scores on attitudes toward COVID-19 preparedness and duty to care than those who did not.

Conclusion: Our findings suggest that mental health of medical students is strongly related to their various aspects related to medical professionalism, especially their attitudes toward COVID-19 preparedness. Good mental health was positively linked to medical professionalism attributes and attitudes toward COVID-19 preparedness. However, knowledge and practice of COVID-19 were negatively associated with willingness to participate in the pandemic response. Additionally, the experience of the 2020 leave of absence impacted the attitudes of medical students toward COVID-19 preparedness (p=0.015) and their duty to care (p=0.012) negatively.

Key Words: Professionalism, Medical students, COVID-19, Knowledge, Practice, Attitude, Duty to care, Mental health

Introduction

The coronavirus disease 2019 (COVID-19) pandemic, which began in 2019, entered South Korea in 2020, with an outbreak centered in the Daegu region in February. In early March, 700-900 new cases were reported every day, prompting Daegu to be declared a special disaster area. In the face of the sudden surge in COVID-19, Daegu’s major hospitals were filled with infected patients, and...
Daegu’s healthcare workers volunteered to serve at the outbreak site, exposing themselves to infection risk and doing their best to clean up the mess. However, stigmatization of these frontline workers was a problem at the time, with some denying them access to public facilities and evicting their families [1,2]. Furthermore, in August 2020, the medical community went on strike and shut down the country in protest of the expansion of medical school capacity and the establishment of public medical schools. The mass class boycott and strikes in South Korea have raised serious concerns among young doctors and prospective doctors about the professional obligations imposed on healthcare providers during an infectious disease crisis [3].

It was not just in South Korea that the coronavirus pandemic had had a significant impact on medical professionalism. A review article published in 2022 examined the various ethical issues that arise in the face of a public health crisis, particularly the issue of involving medical students in infectious disease crises, the lack of protective equipment, the care of unvaccinated patients, and the issue of burnout of medical personnel exacerbated by the pandemic, and argued that existing standards of professionalism should be redefined [4]. However, the pandemic is not the only threat to medical professionalism. Some argue that the pandemic can allow medical students to learn professionalism by awakening them to the need for social responsibility and promoting their participation in related activities [5].

From a medical education perspective, more effective education tools and directions on the topic of medical professionalism have been called for in the wake of the COVID-19 crisis [6]. Internationally, qualitative studies have been conducted on the perceptions of professionalism of medical students during the COVID-19 pandemic [7,8]. Similar studies have been conducted in Korea for nursing students [9], but to date, only a few studies have explored the perceptions of professionalism of Korean medical students among the public health crisis. Identifying factors affecting medical professionalism in medical students during public health crisis is imperative for advancing professionalism education within medical school. Notably, certain demographic characteristics—gender [10], socioeconomic status [11], religious affiliation [12]—have been noted to influence medical students’ perception of medical professionalism, warranting further investigation. Additionally, mental well-being of medical students was found crucial to maintain professional identity [13]. Moreover, the 2020 COVID-19 pandemic in Daegu provided medical students in this region with an opportunity to get the firsthand understanding of the public health crisis, shaping their perception of their roles as healthcare providers. Nonetheless, their engagement with the August leave of absence in the same year had a profound impact on their perceptions of professionalism.

This study examines various factors affecting professionalism aspects among medical students in Daegu in 2020, encompassing their demographic characteristics, mental health, and significant event (e.g., medical students’ leave of absence). We explore several hypotheses: (1) Demographic factors may affect medical students’ professionalism during the COVID-19 pandemic. (2) Mental health status may influence their professionalism. (3) Their experiences during the 2020 leave of absence may influence their professionalism. Through this study, we aimed to enrich our understanding of medical students’ perceptions of professionalism during the COVID-19 pandemic and shed light on the future development of these students’ professionalism education.
Methods

1. Participants and data collection

This study surveyed a medical school in South Korea. A total of 654 students in six grades were surveyed, including 220 premedical and 434 medical students. The survey received 588 responses (89.9%), with 400 responses (61.2%) being analyzed for sincerity. The survey was conducted online from August 3 to October 4, 2020. This study was approved by the Institutional Review Board of Kyungpook National University in July 2020 (KNU-2020 0069). Informed consent was obtained from all individual participants included in the study.

2. Variable and the research instrument

Independent variables in this study included gender, grade, current residence, residence in February–March 2020, healthcare type, religion, survey timing (before or after September 25), and a five-question scale asking about changes in satisfaction with relationships (self, family, friends, school, and community) before and after COVID-19. Although the survey's timing was not specified in the questionnaire, the researchers found that the doctor's strike and the alliance leave of absence occurred during the survey, which may have contributed to differences in the professionalism scores. The variables of emotional characteristics included, first, a nine-item questionnaire on emotional fear of coronavirus, with questions graded on a 4-point scale. Second, four instruments for measuring mental health were included (i.e., anxiety, depression, post-traumatic stress, and resilience).

The study incorporated dependent variables encompassing six aspects across three overarching domains pertaining to medical professionalism. These three domains comprised medical professionalism attributes, knowledge, practice, and attitude (KPA) towards COVID-19, as well as attitude toward care provision during pandemics. Within the domain of “medical professionalism attributes,” respondents were asked about two aspects: their inherent medical professionalism attributes and their self-assessed changes in these attributes after COVID-19 outbreak. The assessment of the KPA score regarding COVID-19 involved inquiries directed at medical students concerning their KPA as future physicians. Furthermore, the investigation delved into respondents’ attitudes regarding their career after graduation and sense of duty toward care provision amidst pandemics, to elucidate their stance on care provision during such exigencies. Accordingly, we assessed six aspects related to medical professionalism, including medical professionalism attributes, self-assessed changes in medical professionalism attributes after COVID-19 outbreak, knowledge and practice about COVID-19 as future physician, attitude toward COVID-19 as future physician, attitude toward careers after graduation, and attitude toward duty to care during pandemic.

1) Medical professionalism attributes

Currently, there is no widely recognized assessment tool for medical professionalism. For this study, we developed a brief self-assessment of medical professionalism attributes based on a widely cited concept of professionalism in the medical community. We constructed a questionnaire based on the definition of medical professionalism mentioned in the world-renowned book "Measuring medical professionalism" by David Thomas Stern [14]. The definition of medical professionalism by Arnold and Stern [14] served as the foundation for the evaluation of the attribute of medical professionalism. According to the American Board of Internal Medicine's Professionalism Project, they defined medical professionalism in terms of seven domains of attributes: excellence, altruism, respect, compassion, empathy, hon-
esty, and accountability [14]. The professionalism attributes questionnaire included seven questions on these topics, which respondents were asked to rate on a 7-point scale. All elements indicated that the Cronbach’s α values were greater than 0.7, with the total value of 0.832, indicating the reliability of the instrument.

2) Self-assessed changes in medical professionalism attributes after COVID-19 outbreak

A self-assessment questionnaire on medical professionalism attributes was used to determine whether there have been self-assessed changes in these attributes after COVID-19 outbreak. A professor majoring in medical humanities and education reviewed the content to ensure its validity. Participants were asked to rate each item on a 7-point scale, ranging from 7 (=very much so, 4=no change) to 1 (=very much the opposite). The closer the score is to 7, the more students evaluate that they have changed positively, and the closer it is to 1, the more negative the students evaluate themselves to have changed.

3) Knowledge and practice about COVID-19 as future physicians

This questionnaire was designed to measure the knowledge and practice of medical students about COVID-19. The knowledge and practice section were developed by referencing Zhong et al. [15] and Olum et al. [16], which measured KPA toward COVID-19 among Chinese trainees during the early stages of the outbreak, but were modified to suit Korean medical students. It consisted of 11 yes/no questions, including nine questions about COVID-19 knowledge and two questions about practice for prevention. We asked various COVID-19 knowledge including its symptom, transmission route, preventive measures, and so forth. Furthermore, the actions taken to prevent COVID-19 were asked to measure practice for prevention.

4) Attitude toward COVID-19 preparedness as future physicians

Zhong et al. [15], who evaluated attitudes and preparedness for crises and disasters, served as an inspiration for the attitudes section, and Gillani et al. [17] served as an inspiration for the disaster preparedness section. The “attitude” questionnaire had 13 items and was rated on a 7-point scale. We surveyed them regarding their leadership, self-assurance, and awareness of their role as future physicians during the pandemic in order to determine their level of preparedness.

5) Attitude toward post-graduation careers and duty to care during pandemic.

The questionnaire on attitudes toward pandemic response after graduation was developed in-house and consisted of four items, rated on a 7-point scale. The attitude toward duty to care during pandemic was adapted from Herman et al. [18], who developed a questionnaire on medical students’ duty to treat during the pandemic medical workforce shortage, with six items to be selected on a 7-point scale. The questionnaires 1) to 5) can be found in Appendix 1.

6) Mental health

Seven questionnaires were used to measure psychological status. Beck Anxiety Inventory (BAI: Cronbach’s α=0.91) [19], which measures anxiety, and the Generalized Anxiety Disorder seven-item (GAD-7: Cronbach’s α=0.92) [20], the Beck Depression Inventory II (BDI-II) was used to assess the appearance and severity of depressive symptoms (Cronbach’s α=0.91) [21] and the Patient Health Questionnaire–9 (PHQ-9) (Cronbach’s α=0.84) [22], primary care post-traumatic stress disorder (PTSD) screen for DSM-5 (Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition) (PC-PTSD-5) [23] to measure post-traumatic stress, Connor–Davidson Resilience Scale (CD-RISC) (Cronbach’s α=0.93) [24] to measure resilience and the Korean version of experiences in the revised Close Relation Questionnaire (ECRR-K14) [25] (Cronbach’s α
=0.93, 0.92) to assess intimacy.

3. Data analysis

Descriptive statistics were used to examine the general characteristics of the study subjects as well as the total score of each test index. First, a one-way analysis of variance was performed to determine whether there were any differences in six variables related to medical professionalism by medical students’ demographics: gender, grade, current residence (August–October), and residence during the February–March period, religion, and type of medical coverage. Scheffe’s test was used for post-hoc testing. Second, Pearson’s correlation analysis was conducted to examine the correlation between six variables related to medical professionalism. Third, Pearson’s correlation analysis was used to analyze the relationship between six major variables associated with medical professionalism and mental health. All statistical significance levels were p<0.05, and IBM SPSS Statistics for Windows ver. 25.0 (IBM Corp, Armonk, USA) was used.

Results

1. Participant demographics

Among the 400 respondents, 66.3% (265) were male, 98.8% (395) were single and 68.3% (273) did not adhere to any specific religion. At the time of the COVID-19 outbreak, 75.9% (303 students) lived in Daegu, 19.3% (77 students) lived alone without a partner, and 96.5% (386 students) received benefits from national health insurance. Demographic characteristics by grade level are summarized in Table 1.

2. Differences in scores related to medical professionalism by gender and grade level

Among the medical professionalism attribute scores, the highest and lowest scores are for respect and altruism, respectively (i.e., excellence, 5.61; respect, 6.00; empathy, 5.77; compassion, 5.41; honesty, 5.64; responsibility, 5.80; and altruism, 4.48). Female students scored significantly higher than male students on the basic attribute of medical professionalism (p=0.002), specifically in terms of respect (p=0.002), compassion (p=0.001), and honesty (p=0.017).

| Table 1. Demographic Characteristics of Respondents per School Grade |
|-----------------------------|-------------------------------|----------------------------|----------------------------|-----------------------------|-----------------------------|
| Variable       | Premedical course | Medical course | Medical course | Medical course | Medical course |
|                | 1st | 2nd | 1st | 2nd | 3rd | 4th | Total | 1st | 2nd | 3rd | 4th | Total |
| Total          | 76  | 57  | 90  | 70  | 49  | 58  | 400  | 19.0 | 14.2 | 17.5 | 12.3 | 14.5 | 100.0 |
| Gender (male)  | 60  | 42  | 55  | 44  | 27  | 37  | 265  | 78.9 | 73.7 | 62.9 | 56.3 | 63.8 | 66.3 |
| Marital status (no) | 76  | 57  | 89  | 70  | 49  | 54  | 395  | 100  | 100  | 100  | 100  | 93.1 | 98.8 |
| Religion (no)  | 42  | 34  | 71  | 50  | 34  | 42  | 273  | 55.3 | 59.6 | 71.4 | 70.8 | 72.4 | 68.3 |
| Residence DG (February to March) | 55  | 45  | 64  | 57  | 38  | 44  | 303  | 72.4 | 78.9 | 81.4 | 79.2 | 75.9 | 75.8 |
| Residence DG² | 54  | 41  | 69  | 57  | 46  | 53  | 320  | 71.1 | 71.9 | 76.7 | 81.4 | 91.4 | 80.0 |
| Living alone (yes) | 3  | 3   | 15  | 28  | 13  | 14  | 77   | 3.9  | 5.3  | 16.7 | 24.0 | 24.1 | 19.3 |

Healthcare coverage type

| Medical aids type 1 | 3 | 1 | 0 | 3 | 1 | 11 | 2.8 |
| Medical aids type 2 | 0 | 1 | 2 | 0 | 0 | 3 | 0.8 |
| National health insurance | 73 | 53 | 87 | 70 | 46 | 2 | 386 | 18.3 | 13.7 | 21.8 | 17.5 | 14.2 | 96.5 |

Data are presented as number of participants to be analyzed (%).
²In the case of living in the Daegu city and Gyeongbuk province in Korea from February to March 2020.
Table 2. Scores Related to Medical Professionalism Including Medical Professionalism Attributes, Knowledge and Practice, Attitude toward COVID-19, and Attitude toward Care Provision during Pandemic of Respondents per Gender and School Grade

<table>
<thead>
<tr>
<th>Gender</th>
<th>Male</th>
<th>Female</th>
<th>t-value</th>
<th>p-value</th>
<th>1st</th>
<th>2nd</th>
<th>3rd</th>
<th>4th</th>
<th>5th</th>
<th>6th</th>
<th>Total</th>
<th>F</th>
<th>p-value</th>
<th>Scheffé</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical professionalism attributes</td>
<td>38.1 ± 6.04</td>
<td>39.8 ± 4.72</td>
<td>-3.12</td>
<td>0.002**</td>
<td>40.6 ± 5.11</td>
<td>38.7 ± 6.30</td>
<td>38.1 ± 5.94</td>
<td>38.4 ± 5.08</td>
<td>37.7 ± 5.59</td>
<td>38.4 ± 5.10</td>
<td>38.7 ± 5.68</td>
<td>2.216</td>
<td>0.052</td>
<td></td>
</tr>
<tr>
<td>Self-assessed changes in medical professionalism attributes after COVID-19 outbreak</td>
<td>32.0 ± 6.24</td>
<td>32.4 ± 5.75</td>
<td>-0.639</td>
<td>0.523</td>
<td>33.1 ± 6.28</td>
<td>31.1 ± 5.87</td>
<td>32.5 ± 6.74</td>
<td>31.4 ± 5.41</td>
<td>31.1 ± 5.71</td>
<td>33.4 ± 5.73</td>
<td>32.2 ± 6.09</td>
<td>1.751</td>
<td>0.122</td>
<td></td>
</tr>
<tr>
<td>Knowledge practice and attitude toward COVID-19</td>
<td>14.9 ± 2.12</td>
<td>14.9 ± 1.93</td>
<td>-0.112</td>
<td>0.911</td>
<td>15.2 ± 1.95</td>
<td>15.2 ± 1.70</td>
<td>14.8 ± 2.19</td>
<td>14.8 ± 1.86</td>
<td>15.1 ± 2.30</td>
<td>14.7 ± 2.25</td>
<td>14.9 ± 2.06</td>
<td>1.351</td>
<td>0.242</td>
<td></td>
</tr>
<tr>
<td>Knowledge and practice about COVID-19 as future physicians</td>
<td>62.4 ± 12.29</td>
<td>64.3 ± 8.86</td>
<td>-1.826</td>
<td>0.069</td>
<td>66.3 ± 11.05</td>
<td>62.3 ± 10.86</td>
<td>63.8 ± 10.96</td>
<td>62.6 ± 12.2</td>
<td>59.3 ± 9.55</td>
<td>61.7 ± 12.18</td>
<td>63.0 ± 11.29</td>
<td>2.722</td>
<td>0.020**</td>
<td></td>
</tr>
<tr>
<td>Attitude toward COVID-19 preparedness as future physicians</td>
<td>17.6 ± 4.47</td>
<td>17.7 ± 3.79</td>
<td>-0.288</td>
<td>0.773</td>
<td>19.2 ± 4.27</td>
<td>18.0 ± 3.86</td>
<td>17.3 ± 4.09</td>
<td>17.1 ± 4.38</td>
<td>16.3 ± 4.15</td>
<td>17.6 ± 4.25</td>
<td>17.7 ± 4.24</td>
<td>3.836</td>
<td>0.003**</td>
<td></td>
</tr>
<tr>
<td>Attitude toward post-graduation career</td>
<td>21.5 ± 6.69</td>
<td>23.0 ± 6.10</td>
<td>-2.273</td>
<td>0.024*</td>
<td>23.2 ± 5.77</td>
<td>21.5 ± 6.43</td>
<td>22.6 ± 6.15</td>
<td>20.4 ± 7.48</td>
<td>20.9 ± 6.32</td>
<td>22.7 ± 6.94</td>
<td>21.9 ± 6.56</td>
<td>1.952</td>
<td>0.085</td>
<td></td>
</tr>
</tbody>
</table>

Data are presented as mean±standard deviation, unless otherwise stated. Year: 1=pre-medical course 1st, 2=pre-medical course 2nd, 3=medical course 1st, 4=medical course 2nd, 5=medical course 3rd, and 6=medical course 4th.
*p<0.05. **p<0.01.
Table 3. Differences in Scores Related to Medical Professionalism by Residency, Healthcare Coverage, and Religion

<table>
<thead>
<tr>
<th>Medical professionalism attributes</th>
<th>Current residence</th>
<th>Residency (February to March)</th>
<th>Medical coverage type</th>
<th>Religion</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td>1</td>
<td>38.6±5.59</td>
<td>38.7±6.11</td>
<td>38.7±5.53</td>
<td>38.8±6.03</td>
</tr>
<tr>
<td>2</td>
<td>32.1±6.13</td>
<td>32.0±5.58</td>
<td>32.2±6.34</td>
<td>31.8±5.35</td>
</tr>
<tr>
<td>Knowledge and practice about COVID-19</td>
<td>15.0±2.06</td>
<td>14.6±2.04</td>
<td>14.9±2.16</td>
<td>14.9±1.86</td>
</tr>
<tr>
<td>4</td>
<td>62.7±11.09</td>
<td>63.7±11.81</td>
<td>63.0±11.08</td>
<td>62.9±11.70</td>
</tr>
<tr>
<td>Attitude toward post-graduation careers</td>
<td>17.6±4.18</td>
<td>17.5±4.49</td>
<td>17.7±4.26</td>
<td>17.3±4.26</td>
</tr>
<tr>
<td>6</td>
<td>21.9±6.35</td>
<td>22.2±7.36</td>
<td>21.9±6.28</td>
<td>22.1±7.19</td>
</tr>
</tbody>
</table>

Data are presented as mean±standard deviation, unless otherwise stated. 1: Medical professionalism attribute, 2: Self-assessed changes in medical professionalism attributes after COVID-19 outbreak, 3: Knowledge and practice about COVID-19 as future physician, 4: Attitude toward COVID-19 preparedness as future physician, 5: Attitude toward post-graduation careers, and 6: Attitude toward duty to care. A: In the case of living in the Daegu city and Gyeongbuk province in Korea, B: In the case of living outside of the Daegu city and Gyeongbuk province in Korea, C: In the case of living in the Daegu city and Gyeongbuk province from February to March 2020, D: In the case of living outside of the Daegu city and Gyeongbuk province from February to March 2020, E: Medical aids, F: National health insurance, G: Person with religion, and H: Person without religion.


*p<0.05. **p<0.01.
Furthermore, women also scored significantly higher than men in attitudes toward duty to care (p=0.024) (Table 2).

When comparing mean scores across grades, first-year medical students scored significantly higher than fifth year ones on their attitudes toward COVID-19 (p=0.020). Moreover, first-year medical students scored significantly higher than fifth year medical students (p=0.003) regarding aspects such as working in public hospitals after graduation. This suggests that first-year premedical students are more confident in their attitudes and preparations for the pandemic and have stronger intentions to enter public healthcare service (Table 2).

3. Differences in scores related to medical professionalism by residency, type of healthcare coverage, and religion

We found no difference in six scores related to medical professionalism based on whether the current residence was Daegu or whether the primary residence was Daegu in February and March 2020. When we tested whether a difference exists in terms of religion, students with religious affiliations reported higher self-assessed changes in their medical professionalism attributes following COVID-19 compared to their non-religious counterparts (p=0.008). Their scores for attitudes toward COVID-19 as future physicians and attitudes toward career after graduation were also higher (p=0.44, p=0.34), respectively (Table 3).

4. Differences in scores related to medical professionalism by the experience of leave of absence in 2020

We then split the responses between before and after medical students returned from the 2020 leave of absence (as of September 25, 2020). We found that students who responded after the leave of absence had significantly lower scores on the attitudes of medical students toward COVID-19 (p=0.015) and their obligation to participate in care (p=0.012) than those who responded before that (Table 4).

5. Correlation between scores related to medical professionalism and mental health

First, professionalism attributes of medical students was positively associated with relationship satisfaction scores (r=0.098, p<0.05) and resilience (r=0.572, p<0.001), whereas it was negatively associated with anxiety (BAI: r=−0.188, p<0.001, GAD-7: r=−0.138, p<0.001), depression (BDI-II: r=−0.328, p<0.001, PHQ-9: r=−0.239, p<0.001), post-traumatic stress (r=−0.226, p<0.001),

<table>
<thead>
<tr>
<th>Table 4. Differences in Scores Related to Medical Professionalism by the Experience of Leave of Absence in 2020 (September 25th)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scores related to medical professionalism</td>
</tr>
<tr>
<td>---------------------------------------------------------------</td>
</tr>
<tr>
<td>Medical professionalism attributes</td>
</tr>
<tr>
<td>1. Medical professionalism attributes</td>
</tr>
<tr>
<td>2. Self-assessed changes in medical professionalism attributes after COVID-19 outbreak</td>
</tr>
<tr>
<td>Knowledge, practice, and attitude toward COVID-19</td>
</tr>
<tr>
<td>3. Knowledge and practice about COVID-19 as future physicians</td>
</tr>
<tr>
<td>4. Attitude toward COVID-19 preparedness as future physicians</td>
</tr>
<tr>
<td>Attitude toward care provision during pandemic</td>
</tr>
<tr>
<td>5. Attitude toward post-graduation careers</td>
</tr>
<tr>
<td>6. Attitude toward duty to care</td>
</tr>
</tbody>
</table>

attachment anxiety ($r=−0.292$, $p<0.001$), and attachment–avoidance ($r=−0.484$, $p<0.001$). It did not correlate with emotional fear of coronavirus.

Second, as above, the self-assessed changes in medical professionalism attribute after COVID–19 outbreak was positively related to relationship satisfaction ($r=0.199$, $p<0.001$) and resilience ($r=0.388$, $p<0.05$), but negatively related to anxiety (BAI: $r=−0.108$, $p<0.05$), depression (BDI-II: $r=−0.328$, $p<0.001$, PHQ-9: $r=−0.239$, $p<0.001$), post–traumatic stress ($r=−0.226$, $p<0.001$), attachment anxiety ($r=−0.292$, $p<0.001$), and attachment–avoidance ($r=−0.484$, $p<0.001$). Emotional fear of coronavirus was not correlated with GAD-7 anxiety scores.

Third, unlike the above, the knowledge and practices score of medical students was not correlated with any of the affective scores.

Fourth, “attitude toward COVID–19 preparedness” as future physician showed a positive correlation with relationship satisfaction scores ($r=0.174$, $p<0.001$) and resilience total scores ($r=0.419$, $p<0.001$). The scores of the four sub-domains of resilience (hardness, persistence, optimism, and spiritual support) showed positive correlations with the “attitude toward COVID–19 preparedness,” respectively ($r=0.399$, $r=0.405$, $r=0.345$, $r=0.354$, $r=0.241$, $p<0.001$). In contrast, “attitude toward COVID–19 preparedness” showed negative correlations with anxiety (BAI: $r=−0.241$, $p<0.001$; GAD–7: $r=−0.219$, $p<0.001$), depression (BDI-II: $r=−0.320$, $p<0.001$; PHQ-9: $r=−0.240$, $p<0.001$), post–traumatic stress ($r=−0.251$, $p<0.001$), attachment anxiety ($r=−0.242$, $p<0.001$), and attachment–avoidance ($r=−0.352$, $p<0.001$). It was also negatively correlated with emotional fear of the coronavirus ($r=−0.130$, $p<0.001$).

Fifth, attitudes toward career after graduation were only statistically correlated with resilience total scores ($r=0.279$, $p<0.001$) and the four subdomains: hardness, persistence, optimism, and spiritual support, respectively ($r=0.265$, $r=0.262$, $r=0.260$, $r=0.176$, $r=0.198$, $p<0.001$). On the other hand, it was negatively related to anxiety (BAI: $r=−0.194$, $p<0.001$, GAD–7: $r=−0.207$, $p<0.001$), depression (BDI-II: $r=−0.257$, $p<0.001$, PHQ-9: $r=−0.243$, $p<0.001$), post–traumatic stress ($r=−0.130$, $p<0.001$), and attachment–avoidance ($r=−0.176$, $p<0.001$). Meanwhile, attitudes toward career after graduation were unrelated to relationship satisfaction, fear of COVID–19, or attachment anxiety.

Sixth, attitude of the duty to care during is determined by the resilience total score ($r=0.279$, $p<0.001$) and the four subdomains: hardness, persistence, optimism, and spiritual support, each of which showed a positive correlation with it ($r=0.265$, $r=0.262$, $r=0.260$, $r=0.176$, $r=0.198$, $p<0.001$). However, it was negatively related to anxiety (BAI: $r=−0.169$, $p<0.001$, GAD–7: $r=−0.200$, $p<0.001$), depression (BDI-II: $r=−0.246$, $p<0.001$, PHQ-9: $r=−0.184$, $p<0.001$), post–traumatic stress ($r=−0.117$, $p<0.001$), and attachment–avoidance ($r=−0.111$, $p<0.001$). Meanwhile, attitudes toward careers were not related to relationship satisfaction, fear of COVID–19, or attachment anxiety. The details are shown in Table 5.

6. Correlation between each score related to medical professionalism

The correlations between the six scores related to medical professionalism showed that medical professionalism attributes were significantly and positively related to self-assessed changes in medical professionalism attributes after COVID–19 outbreak ($r=0.426$, $p<0.001$), attitudes toward COVID–19 as a future physician ($r=0.397$, $p<0.001$), attitudes toward post–graduation careers ($r=0.355$, $p<0.001$), and attitudes toward physicians’ duty to practice ($r=0.150$, $p<0.001$). Self–assessed changes in medical professionalism after COVID–19 were significantly positively correlated with the attitude score as a future physician ($r=0.324$, $p<0.001$).
Table 5. Correlation between Scores Related to Medical Professionalism and Mental Health Scores, and Correlation between Each Score Related to Medical Professionalism

<table>
<thead>
<tr>
<th>Medical professionalism attributes</th>
<th>Knowledge, practice, and attitude toward COVID-19 as future physician</th>
<th>Attitude toward COVID-19 preparedness as future physician</th>
<th>5. Attitude toward post-graduation career</th>
<th>6. Attitude toward duty to care</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relationship satisfaction 0.098*</td>
<td>0.199**</td>
<td>-0.032</td>
<td>0.174**</td>
<td>0.066</td>
</tr>
<tr>
<td>Resilience-total score 0.572**</td>
<td>0.368*</td>
<td>0.012</td>
<td>0.419**</td>
<td>0.279**</td>
</tr>
<tr>
<td>Resilience-hardness 0.523**</td>
<td>0.357**</td>
<td>-0.004</td>
<td>0.399**</td>
<td>0.265**</td>
</tr>
<tr>
<td>Resilience-persistence 0.598**</td>
<td>0.353**</td>
<td>0.029</td>
<td>0.405**</td>
<td>0.262**</td>
</tr>
<tr>
<td>Resilience-optimism 0.487**</td>
<td>0.392**</td>
<td>0.018</td>
<td>0.345**</td>
<td>0.260**</td>
</tr>
<tr>
<td>Resilience-support 0.447**</td>
<td>0.262**</td>
<td>-0.046</td>
<td>0.354**</td>
<td>0.176**</td>
</tr>
<tr>
<td>Resilience-spiritual 0.261**</td>
<td>0.283**</td>
<td>0.05</td>
<td>0.241**</td>
<td>0.198**</td>
</tr>
<tr>
<td>BAI scores -0.188**</td>
<td>-0.108*</td>
<td>0.008</td>
<td>-0.241**</td>
<td>-0.194**</td>
</tr>
<tr>
<td>GAD-7 scores -0.138**</td>
<td>-0.057</td>
<td>-0.011</td>
<td>-0.219**</td>
<td>-0.207**</td>
</tr>
<tr>
<td>BDI-II scores -0.328**</td>
<td>-0.219**</td>
<td>-0.04</td>
<td>-0.320**</td>
<td>-0.257**</td>
</tr>
<tr>
<td>PHQ-9 scores -0.239**</td>
<td>-0.208**</td>
<td>-0.009</td>
<td>-0.240**</td>
<td>-0.243**</td>
</tr>
<tr>
<td>PCL-5 scores -0.226**</td>
<td>-0.126*</td>
<td>-0.046</td>
<td>-0.251**</td>
<td>-0.130**</td>
</tr>
<tr>
<td>Attachment-anxiety -0.292**</td>
<td>-0.092</td>
<td>-0.027</td>
<td>-0.242**</td>
<td>-0.096</td>
</tr>
<tr>
<td>Attachment-avoidance -0.484**</td>
<td>-0.219**</td>
<td>-0.104</td>
<td>-0.352**</td>
<td>-0.176**</td>
</tr>
</tbody>
</table>

Correlations between each score related to medical professionalism

| 1 | 1 |
| 2 | 0.426** | 1 |
| 3 | 0.071 | -0.088 | 1 |
| 4 | 0.397** | 0.324** | -0.021 | 1 |
| 5 | 0.355** | 0.355** | -0.046 | 0.604** | 1 |
| 6 | 0.150** | 0.296** | -0.133** | 0.394** | 0.492** | 1 |


*p<0.05. **p<0.01.
attitude score toward post-graduation careers (r=0.355, p<0.001), and attitudes toward physicians’ duty to practice (r=0.296, p<0.001). The attitude score of medical students was significantly positively correlated with attitudes toward post-graduate career paths (r=0.604, p<0.001) and attitudes toward physicians’ duty to care (r=0.394, p<0.001). The attitude toward post-graduation career was significantly positively correlated with the attitude toward the obligation to practice (r=0.492, p<0.001). In conclusion, medical professionalism, self-assessed changes in medical professionalism, COVID-19 attitude score, attitude toward post-graduation career, and attitude toward physicians’ duty to treat were highly correlated (Table 5).

However, overall scores related to medical professionalism were not significantly correlated with knowledge and practice scores, nor were knowledge and practice scores significantly correlated with attitudes as future physicians and attitudes toward post-graduation careers. Furthermore, the knowledge and practice score of medical students were significantly negatively correlated with their attitude toward physicians’ duty of care (r=−0.133, p<0.001).

Discussion

The correlation between the scores related to medical professionalism and demographic characteristics was significantly different in terms of gender, grade, medical coverage type, and religion than for other factors like current residence and time of residence in Daegu. When examining the distribution of scores on the attributes of medical professionalism by demographics, this study determined that gender differed more than other factors. Significant differences exist between men and women in the areas of respect (p=0.002), compassion (p=0.001), and honesty (p=0.017). In our study, while female students appeared to be more positive about participating in pandemic care obligations than male students, other studies [26] found no significant gender differences in preceptors’ perceptions of their obligations to provide pandemic care, or even another systematic review [27] which found that female physicians with parental responsibilities during the pandemic were less likely to continue practicing, contrary to our findings. However, previous studies involved women with caregiving responsibilities, whereas our study focused on female students without caregiving obligations, leading our researchers to interpret the differing results in pandemic care participation based on gender between our study and previous research.

Students with religious affiliation showed more self-assessed changes in medical professionalism in positive way after COVID-19 than non-religious students. This result was consistent with higher scores on attitudes toward COVID-19 preparedness and attitudes toward career after graduation among religious students. This result resonates the result of previous research in Brazil showing high attitudinal score of religious students than non-religious students [12].

The scores related to medical professionalism were associated with greater satisfaction and resilience in relationships and lower levels of anxiety, suggesting that professionalism is highly correlated with mental health. A large body of literature has recognized the importance of maintaining good mental health in maintaining professionalism, with medical students experiencing high levels of burnout [13]. Burnout is strongly associated with self-reported professional deviant behavior and decreased altruistic values among medical students. Our findings are consistent with previous research indicating that the mental health of medical students should be addressed to maintain and promote.
Medical professionalism attribute was also found to be significantly related to both self-assessed changes in medical professionalism attribute after COVID-19 outbreak, and attitudes toward COVID-19 preparedness scores, indicating the importance of medical professionalism attributes in disaster preparedness. However, knowledge and practice scores on COVID-19 were negatively associated with attitudes toward COVID-19 preparedness scores and intentions to work in a public hospital after graduation, suggesting that knowledge and practice did not positively impact attitudes toward disaster response. The discovery that first-year students with less exposure to medical school learning had significantly higher attitudinal scores on the COVID-19 preparedness and intentions to work in public hospitals after graduation than fifth year students showed deviation from previous findings. Further research is warranted to explore specific reasons why first-year students without prior clinical medicine exposure or hospital practicum experience exhibited higher attitude scores towards COVID-19 preparedness and greater willingness to engage in public hospital service post-graduation compared to higher-year students who had undergone hospital practicum.

Duty to care and COVID-19-related attitude scores were significantly lower among those who experienced the student leave of absence of August 2020 compared to those who did not. It is widely assumed that medical students and early-career physicians are more supportive of physician strikes and are less likely to regard them as unethical as more senior physicians who are directly responsible for patient outcomes [28]. Given these findings, medical students who participated in the August 2020 student leave of absence were more likely to be sympathetic to the strike’s cause, and as a result, their perceptions of medical professionalism were influenced more. Due to their exposure to the hostility of Korean citizens displayed toward doctors during the 2020 strike, medical students’ sensitivity to their duty to care during the pandemic may have decreased. It is important to note that medical students’ perceptions of medical professionalism may be influenced by their experience with 2020 leave of absence. There will be a need for discussion in terms of doctors’ social accountability. According to the 2023 report of the Research Institute for Healthcare Policy, policy measures to strengthen the social responsibility of medicine include education on the value of social responsibility in medicine, specification of educational content related to social responsibility in medicine, and content of social responsibility education in the medical school curriculum. Proposals were made on the role of related organizations to strengthen integration and social responsibility education [29]. The Association for Medical Education in Europe guideline also emphasized the responsibility of medical schools for community health and presented methods [30]. In the future, it seems necessary to discuss educational cases and curriculum development in medical schools in terms of doctors’ social participation and social responsibility.

In conclusion, the 2020 coronavirus pandemic posed new challenges for physicians and raised questions about how to teach professionalism to medical students. This study examined how the level of medical professionalism among a sample of medical students during the 2020 pandemic was related to students’ personal characteristics, including mental health and attitudes surrounding the pandemic. The results showed that the scores on the medical professionalism were strongly associated with attitudes toward the COVID-19 preparedness. However, COVID-19 knowledge and practice scores were negatively correlated with attitudes toward the COVID-19 preparedness and post-graduation public hospital employment. This indicates that knowledge of COVID-19 does not significantly impact the willingness to participate in the pandemic response. Furthermore, the findings suggest
that various efforts to support mental health are necessary to maintain professionalism during the pandemic. These results may imply that maintaining professionalism during the pandemic requires efforts to support mental health, which may even be more significant than simply spreading knowledge of the pandemic.

Meanwhile, students who experienced the 2020 medical student strike had lower scores on both attitudes toward the COVID-19 preparedness and their obligation to participate in care. Based on these findings, future research should study the educational content and methods needed to promote professionalism and encourage participation in infectious disease outbreak response during upcoming epidemics.

ORCID:
Eun Kyung Choi: https://orcid.org/0000-0003-1448-1565;
Sanghee Yeo: https://orcid.org/0000-0002-6210-6789

Acknowledgements: None.

Funding: This research was supported by Kyungpook National University Research Fund, 2020.

Conflicts of interest: Sanghee Yeo serves as an Editorial Board member of the Korean Journal of Medical Education but has no role in the decision to publish this article. Except for that, no potential conflict of interest relevant to this article was reported.

Author contributions: Conception or design of the work: EKC; data collection: SY; data analysis and interpretation: SY; drafting the article: EKC, SY; critical revision of the article: EKC, SY; and final approval of the version to be published: all authors.

References

10. Eun Kyung Choi and Sanghee Yeo: Medical students’ professionalism during COVID-19


Appendix 1. Survey Questions about Medical Students’ Professionalism during COVID-19 Outbreak

I. Questions about medical professionalism in relation to coronavirus disease 2019 (COVID-19)

☐ Medical professionalism attributes

The following questions ask your medical professionalism traits. Please answer the following survey questions honestly.

Strongly agree (7) ------------ Neutral (4) ------------ Strongly disagree (1)

1. I tend to consistently exert efforts to become better than average.
2. I lean towards respecting the choices and rights of others.
3. I am inclined to understand and communicate from the perspective of others.
4. I empathize with the suffering of others and am easily moved by their efforts to overcome it.
5. I am straightforward and honest.
6. I excel in fulfilling personal, familial, and societal responsibilities.
7. I prioritize the interests of others.

☐ Self-assessed changes in medical professionalism attributes after COVID-19 outbreak.

The following questions evaluate your self-assessed changes in medical professionalism traits after COVID-19. Please answer the following survey questions honestly.

Changed very much (7) ------- Stayed the same (4) ------- Changed very much in the opposite direction (1)

1. Since the onset of COVID-19, I have found myself making even more sustained efforts to surpass the norm.
2. Post-COVID-19, I have developed a deeper respect for the choices and rights of others.
3. Following COVID-19, I have endeavored to understand and communicate from the perspective of others even more diligently.
4. In the aftermath of COVID-19, I have become more empathetic towards the suffering of others and have been even more deeply moved by their resilience.
5. Since COVID-19, I have exerted greater efforts to be honest and sincere.
6. Post-COVID-19, I have strived to fulfill personal, familial, and societal responsibilities to a greater extent.
7. Since COVID-19, I have endeavored to prioritize the interests of others.

II. Evaluation of knowledge, practices toward COVID-19 and attitudes toward COVID-19 preparedness

The following questions will assess your knowledge, practices, and attitudes toward COVID-19 as future physicians. Please answer the following survey questions honestly.

☐ Knowledge

Please respond with “yes” or “no” for the following knowledge about COVID-19.

1. Major symptoms of COVID-19 include the following:
   - Fever
   - Headache
   - Muscle pain
   - Loss of smell
   - Sore throat
   - Runny nose
   - Sneezing
   - Diarrhea
   - Cough

2. Wildlife consumption or contact can lead to infection with COVID-19.
3. Individuals infected with COVID-19 do not transmit the virus to others if they do not have a fever.
4. The COVID-19 virus is transmitted through the respiratory droplets of an infected person.
5. To prevent COVID-19 virus transmission, general practitioners may wear regular medical masks.
6. There is no need to take measures to prevent COVID-19 virus infection in children or young adults.
7. To prevent COVID-19 infection, individuals should avoid taking trains or going to crowded places such as train stations.
8. Isolating and treating individuals infected with COVID-19 is an effective way to reduce virus transmission.
9. Those who have been in contact with individuals infected with the COVID-19 virus should be promptly isolated in appropriate locations.
10. The usual observation period is 14 days.

☐ Practices
Please respond with “yes” or “no” for the following questions.
11. Have been in a crowded place with more than 50 people within the past week.
12. Have not worn a mask when going out within the past week.

☐ Attitudes toward COVID-19 preparedness
Please respond with 7-points Likert for the following questions.
Strongly agree (7) ------------ Neutral (4) ------------ Strongly disagree (1)
13. COVID-19 will ultimately be successfully controlled.
14. I am confident that Korea will prevail in the fight against the COVID-19 virus.
15. Representatives of the School of Medicine at Kyungpook National University, including the dean, are confident in effectively controlling the COVID-19 pandemic.
16. Professors at the School of Medicine at Kyungpook National University are confident in effectively controlling the COVID-19 pandemic.
17. Observing the response to the COVID-19 outbreak in the Daegu region has instilled pride and confidence in me as a future physician.
18. Observing the crisis of the COVID-19 outbreak in the Daegu region has created anxiety about the identity of being a future physician.
19. I have confidence that I will effectively cope with the COVID-19 pandemic as a future physician.
20. If there are educational programs on coping with pandemics like COVID-19 in the future, I would like to participate.
21. I aspire to take on a leadership role within the group of future physicians in dealing with the COVID-19 pandemic in the future.
22. In the event of a serious COVID-19 outbreak, I have personal, peer, and family-level response plans.
23. If the COVID-19 outbreak worsens, I plan to share my devised personal, peer, and family-level response plans with those around me.
24. In the event of a serious COVID-19 outbreak, I can explain my role to others, including peers and the media.
25. If the COVID-19 outbreak worsens and there is a shortage of healthcare personnel, I would like to volunteer as a future physician.

☐ Attitudes towards career after graduation regarding pandemic (for a 4th-year medical student)
Strongly agree (7) ------------ Neutral (4) ------------ Strongly disagree (1)
1. I am adequately prepared to dive into the frontlines of patient care during a pandemic as an intern after graduation.
2. I am capable of enhancing my skills to be able to engage in frontline pandemic patient care after graduation.
3. The current preventive measures taken by hospitals and schools are sufficient to mitigate pandemic outbreaks.
4. I am willing to offer support if there is a need for healthcare professionals to work in the public sector in the future.

☐ Attitudes towards duty to care during pandemic
Strongly agree (7) ------------ Neutral (4) ------------ Strongly disagree (1)
1. In the event of a shortage of healthcare professionals during the COVID-19 pandemic, medical students may be encouraged to volunteer for clinical service voluntarily.
2. In the event of a shortage of healthcare professionals during the COVID-19 pandemic, retired healthcare professionals may be encouraged to
3. Medical students have a moral obligation to volunteer for clinical service voluntarily during the COVID-19 pandemic.

4. If volunteers are lacking during the COVID-19 pandemic, it is justified for the government to impose clinical service obligations on healthcare professionals.

5. If medical students refuse to comply with government policies requesting pandemic clinical service obligations, penalties and sanctions may be necessary.

6. If faculty members at medical schools refuse to comply with government policies requesting pandemic clinical service obligations, penalties and sanctions may be necessary.