INTRODUCTION

On January 30, 2020, the World Health Organization (WHO) declared coronavirus disease (COVID-19) as a pandemic. The disease had first surfaced in Wuhan, China and soon engulfed the entire world. As of May 2021, over 153 million cases and about 3.2 million (fatality of 2%) deaths related to COVID-19 were notified to the WHO. Meanwhile, Korea reported a total of 367,974 confirmed cases and 2,874 deaths as of November, 2021. This pandemic has greatly affected numerous of aspects of our society, and altered our personal lives and the public and global economies. Although its impact on physical health is the most important issue, attention must be paid to its effect on psychological health also. Vague fears about a protracted virus outbreak, limited movement owing to mass lockdowns, and economic recession have raised psychological distress in the society, which could lead to anxiety, depression, and even suicide. A systematic meta-analysis by Salari et al. identified the prevalence of stress (29.6%), anxiety (31.9%),
and depression (33.7%) in a general population sample during the COVID-19 pandemic.

Public workers’ distress, public service motivation, and work engagement in COVID-19

Public servants have experienced an enormous workload since the outbreak of COVID-19. The longer the pandemic persists, the longer they will have to grapple with crippling work pressure. A study has confirmed that such workplace-related changes might affect public workers’ psychosocial abilities, which lead to burnouts, sick leave, and a decline in work performance and work motivation.8

Perry and Wise9 defined public service motivation (PSM) as "an individual's predisposition to respond to motives grounded primarily or uniquely in public institutions and organizations." A concern for the community and an eagerness to serve the common interest seem to be the major driving factors for public employees, which refers to a work ethic that values extrinsic rewards over intrinsic rewards.10 It has three motives: the rational motive, the norm-based motive, and the affective motive.11 The rational motive reflects the individual's utility maximization, which enables them to engage in policymaking processes and defend special interests. The norm-based motive alludes to an aim for public interest and social equity and can be explained as patriotism and loyalty to the government.12 The affective motive represents humanity, which refers to a volition to help others, and includes altruism, compassion (COM), and self-sacrifice (SS).9

Work engagement was first conceptualized by Kahn12 as a state of total involvement in work-related roles physically and mentally. Later, it was categorized in three dimensions: vigor, dedication, and absorption.13 Vigor is defined as high levels of energy and mental resilience during work time.14 Dedication is strongly correlated with one's volition to work, experiencing a feeling of significance, enthusiasm, inspiration, and pride.14,15 Absorption is characterized as being in a state of full concentration and devoting oneself happily to one's work, where time flies and it could become difficult to part from the endeavor.16,17

Studies have repeatedly disputed the associations between PSM and work engagement as well as the affecting factors for each during non-pandemic years. Deng et al.18 reported that PSM is highly influenced by stress among Chinese healthcare workers—positively by challenge stress and negatively by hindrance stress. Hindrance stress includes unnecessary impediments that prevent career development and goal achievement, such as organizational politics, job insecurity, and role conflict.19,20 However, PSM has a positive effect on job performance,21 and each PSM dimension affects work engagement differently.22 Additionally, it has been reported that work stress could directly or indirectly lower work efficiency by under-mining PSM.23 Resilience, which refers to one's ability to endure stressful situations or cope with environmental adversity,24 was found to be a partial mediator between work stress and burnout symptoms among civil servants.25 Work stress is, presumably, among the most significant antecedent factors that negatively affect work engagement, through the possible mediating parameters, PSM, or resilience during the pandemic era.

Psychological distress associated with COVID-19 had a strong link with burnout symptoms according to a study in Turkey.26 Another study of public servants had confirmed resilience as an effective mediator and moderator when explaining the association between stress, anxiety, and depression.27 Similarly, we have investigated the role of resilience, which would intervene the relationship between depression and anxiety reactions during the pandemic.28 We verified a hypothesis that resilience could provide appropriate coping strategies for public servants to overcome mental stress during the pandemic. Anxiety and depressive symptoms have not been debated as predicting factors for PSM, and, to the best of our knowledge, no study has yet investigated the relation between PSM and pandemic-induced stress. Although PSM has to be considered differently from ordinary job motivation, stress related to the pandemic might impair PSM, eventually provoking depression.

This study investigated the influence of public workers’ work-related stress or viral anxiety on their depression and work engagement during the COVID-19 pandemic. Additionally, we explored whether their PSM or resilience mediates this association.

METHODS

Participants and procedure

This online survey study was conducted with the help of a professional survey company (www.embrain.com). The respondents were notified of the study’s objective and enrollment procedure, and their participation was voluntary. The sample size was estimated based on the principles of 30 participants per cell.29 We assigned 30 to 40 samples for each 10 cells, which were categorized by biological sex (two groups) and age (five groups). Approximately 5,000 to 6,000 public worker panelists received an email from the company for registration of the study. All 300 eligible participants’ responses were collected among 1,451 panelist who showed interest in undertaking the survey. This stands for about 0.03% of all registered public workers (1,068,626 based on the census of public workers in 2018) in South Korea.30

From April 1 till April 12, 2021, 300 public workers were enrolled. The survey was conducted anonymously and no per-
sonal information was collected. The study protocol was approved by the Institutional Review Board (2021-0448) of the ASAN Medical Center, and the written informed consent requirement was waived. The survey form was developed according to the Checklist for Reporting Results of Internet Surveys guidelines, and an investigator (S.C.) tested the usability and technical functionality prior to implementation. We collected information about the participants’ age, sex, roles, years of employment, and marital status. Additionally, we included items related to COVID-19: “Did you experience being quarantined because of infection with COVID-19?” and “Did you experience being infected with COVID-19?” To ascertain their past and present psychiatric symptoms, we asked: “Have you experienced or undergone treatment for depression, anxiety, or insomnia?” and “Now, do you think you are depressed or anxious, or do you need help for your mood state?”

Symptom assessment

The Stress and Anxiety to Viral Epidemics–6 items scale
The Stress and Anxiety to Viral Epidemics–6 items (SAVE-6) scale was developed to measure the viral anxiety of the general population. It was derived from the original Stress and Anxiety to Viral Epidemics–9 scale, which was developed by Chung et al., ASAN Medical Center, University of Ulsan College of Medicine, to measure healthcare workers’ work-related stress and anxiety response during the COVID-19 pandemic. The respondents could answer each item on a 5-point Likert scale ranging from 0 (never) to 4 (always). Higher SAVE-6 total score reflected a severe degree of viral anxiety. The SAVE-6 scale was originally developed in the Korean language, and we applied the original version in this study. Cronbach’s alpha was 0.817 among this sample.

The Public Service Motivation scale
The Public Service Motivation scale (PSM) was first defined by Perry and Wise based on the three motives, as explained in the introduction. It consists of four components: attraction to policy making (APM), commitment to public interest (CPI), COM, and SS. The original scale comprises 24 items: three items for APM, five for CPI, eight for COM, and eight for SS. A 5-point Likert scale was used to evaluate, ranging from 1 (strong disagreement) to 5 (strong agreement). In this study, we applied an abridged version of the PSM scale translated into Korean, with 10 items: three for APM, three for CPI, four for COM, and three for SS. Cronbach’s alpha was 0.801 among this sample.

The Nine-item Utrecht Work Engagement Scale (UWES-9)
The Nine-item Utrecht Work Engagement Scale (UWES-9) is a shortened version of the original 17-item questionnaire (original 17-item Utrecht Work Engagement Scale), which measures work engagement. It comprises nine items, which can be rated on a 7-point Likert scale ranging from 0 (never) to 6 (always). A higher total score on the UWES-9 reflects a high level of work engagement. We applied the Korean version of the UWES-9 in this study, and Cronbach’s alpha was 0.949 among this sample.

The Korean Occupational Stress Scale–Short Form
Work-related stress was assessed using the Korean Occupational Stress Scale–Short Form (KOSS-SF), a 24-item self-rating scale developed for estimating occupational stress among Korean employee. Each item was rated on a scale of 1 (not at all) to 4 (very much). A high total score reflected a high level of work-related stress. Cronbach’s alpha was 0.646 among this sample.

The Brief Resilience Scale
The Brief Resilience Scale (BRS) is a rating scale for resilience, that is, the capacity to recover quickly from difficulties. The participants rated each question on a scale of 1 to 5, and score was calculated by reverse coding items 2, 4, and 6. A higher score (ranging from 6 to 30) reflects a high level of resilience. In this study, we applied the Korean version of the BRS. Cronbach’s alpha was 0.927 among this sample.

The Patient Health Questionnaire–9 items (PHQ–9) scale
The Patient Health Questionnaire–9 items (PHQ-9) is a rating scale for depression, and items were rated on a scale of 0 (not at all) to 3 (nearly every day). High total score reflected high levels of depression (0 to 4, minimal depression; 5 to 9, mild depression; 10 to 14, moderate depression; 15 to 19, moderately severe depression; and ≥20, severe depression). Cronbach’s alpha was 0.914 among this sample.

Statistical analysis
Statistical analysis was conducted using SPSS ver. 21.0, AMOS ver. 27 (for Windows; IBM Corp., Armonk, NY, USA), JASP ver. 0.14.1 (https://jasp-stats.org/), and Jamovi ver. 1.6.23 (https://www.jamovi.org). Clinical variables were summarized as mean±standard deviation, and the significance level was defined as two-tailed, p<0.05. To examine the expecting variables for public workers’ work engagement, the participants were categorized into two groups: UWES-9 top 25% group and UWES-9 bottom 75% group. Chi-square tests for categorical variables and the Student t-test for continuous variables were performed to explore the between-group difference. Pearson’s correlation analysis was performed to explore the correlations among clinical variables and rating scales.
scores. The linear regression analysis revealed the expecting variables for the high work engagement. Finally, the bootstrap method with 2,000 resamples was implemented to explore the mediation effect of resilience on work-related stress with work engagement.

RESULTS

Among the 300 participants, 166 (55.3%) were male, and 180 (60%) were national government workers; the mean age was 38.3±9.1 years old, and mean years of employment was 10.3±8.8 years. The respondents were sampled from Seoul (n=72, 24.0%), Pusan (n=18, 7.0%), Daegu (n=10, 3.3%), Daejeon (n=17, 5.7%), Gwangju (n=9, 3.0%), Incheon (n=15, 5.0%), Ulsan (n=4, 1.3%), Sejong (n=10, 3.3%), the Gyeonggi Province (n=51, 17.0%), the Chungcheong Province (n=18, 6.0%), the Jeolla Province (n=25, 8.3%), the Gyeongsang Province (n=28, 6.0%), the Gangwon Province (n=21, 7.0%), and the Jeju Province (n=2, 0.7%). When we grouped participants based on the degree of work engagement scale (UWES-9) top 25% and bottom 75% groups (Table 1), there was significant difference in sex (p=0.03) and the proportion of workers needing help for their mood state (p=0.04). Scores of the PHQ-9 and the KOSS-SF were significantly lower, and BRS and PSM scale scores were significantly higher among public workers in the UWES-9 top 25% group. No significant difference was observed in the SAVE-6 scale score between the two groups.

Spearman’s correlation analysis (Table 2) showed that long years of employment were significantly associated with high work engagement and low levels of depression. However, the degree of association was weak, which needs to be interpreted cautiously. Work engagement was significantly associated with low level of depression and work-related stress, and high levels of service motivation and resilience. Viral anxiety was associated with high level of depression and low level of resilience. Public workers’ depression was correlated with low level of service motivation and resilience, and high level of work-related stress. PSM was associated with a high level of resilience and low level of work-related stress. Their resilience was associated with low level of work-related stress.

The linear regression analysis revealed that high level of work engagement of public workers was expected by high level of PSM (β=0.28, p<0.001), high level of resilience (β=0.30, p<0.001), and low level of work-related stress (β=−0.40, p<0.001) (F=57.4, p<0.001; Table 3). Public workers’ high level

<table>
<thead>
<tr>
<th>Variable</th>
<th>UWES-9 top 25% (N=74)</th>
<th>UWES-9 bottom 75% (N=226)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex (male)</td>
<td>49 (66.2)</td>
<td>117 (51.8)</td>
<td>0.03</td>
</tr>
<tr>
<td>Public worker</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>National government worker</td>
<td>48 (64.9)</td>
<td>132 (58.4)</td>
<td>0.34</td>
</tr>
<tr>
<td>Local government worker</td>
<td>26 (35.1)</td>
<td>94 (41.6)</td>
<td>0.11</td>
</tr>
<tr>
<td>Age (yr)</td>
<td>39.8±9.9</td>
<td>37.8±8.8</td>
<td>0.29</td>
</tr>
<tr>
<td>Year of employment</td>
<td>11.3±9.9</td>
<td>9.9±8.5</td>
<td>0.02</td>
</tr>
<tr>
<td>Marital status (married)</td>
<td>44 (59.5)</td>
<td>118 (52.2)</td>
<td>0.35</td>
</tr>
<tr>
<td>COVID-19 questions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Did you have experience dealing with confirmed COVID-19 clients? (Yes)</td>
<td>19 (25.7)</td>
<td>64 (28.4)</td>
<td>0.77</td>
</tr>
<tr>
<td>Did you experience being quarantined due to infection with COVID-19? (Yes)</td>
<td>14 (18.9)</td>
<td>31 (13.7)</td>
<td>0.27</td>
</tr>
<tr>
<td>Psychiatric history</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Did you have experience or treated depression, anxiety, or insomnia? (Yes)</td>
<td>7 (9.5)</td>
<td>39 (17.3)</td>
<td>0.14</td>
</tr>
<tr>
<td>Now, do you think you are depressed or anxious, or do you need help for your mood state? (Yes)</td>
<td>4 (5.4)</td>
<td>33 (14.6)</td>
<td>0.04</td>
</tr>
<tr>
<td>Rating scales scores</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stress and Anxiety to Viral Epidemics–6 items</td>
<td>16.6±4.9</td>
<td>16.6±3.9</td>
<td>0.88</td>
</tr>
<tr>
<td>Patient Health Questionnaire–9 items</td>
<td>5.8±6.0</td>
<td>7.8±5.9</td>
<td>0.01</td>
</tr>
<tr>
<td>Korean Occupational Stress Scale</td>
<td>56.3±5.3</td>
<td>61.4±5.5</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Public Service Motivation</td>
<td>32.9±5.2</td>
<td>28.0±5.1</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Brief Resilience Scale</td>
<td>21.6±4.3</td>
<td>17.7±4.3</td>
<td>&lt;0.01</td>
</tr>
</tbody>
</table>

Values are presented as number (%) or mean±standard deviation. COVID-19, coronavirus disease; UWES-9, Nine-item Utrecht Work Engagement Scale
of depression was expected by fewer years of employment (β=-0.12, p=0.02), high viral anxiety (β=0.21, p<0.001), and low resilience (β=-0.42, p<0.001) (F=22.1, p<0.001).

The mediation analysis results showed that the complete pathway from work-related stress of public workers (independent variable) to their resilience and PSM (mediator) to work engagement (dependent variable) was significant (Z=-12.29, p<0.001; Table 4). This result indicates that public workers’ resilience and PSM partially mediate the effects of work-related stress on work engagement (Figure 1). Public workers’ depression was influenced by viral anxiety in the COVID-19 pandemic, and their resilience mediated the association. However, PSM did not mediate the association (Table 4 and Figure 2).

DISCUSSION

It was observed that public workers’ work engagement was predicted by PSM, resilience, and low level of work-related stress. Their depression was expected by fewer years of employment, high viral anxiety, and low resilience. Resilience and PSM partially mediate the effects of work-related stress on work engagement. Depression was influenced by viral anxiety during the COVID-19 pandemic, and resilience mediated the association. However, PSM did not mediate the association.

Work-related stress, positive service motivation, resilience, and work engagement of public workers during the COVID-19 pandemic

It has already been reported that hindrance stress adversely impacts one’s psychological state, thus causing exhaustion and loss of passion and drive to work.43 We found that high levels of work-related stress was significantly related with low levels of work engagement, consistent with studies conducted before the COVID-19 pandemic. Our results were similar to those

Table 2. Spearman correlation coefficients of each variables in all participants (N=300)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Year of employment</th>
<th>UWES-9</th>
<th>SAVE-6</th>
<th>PHQ-9</th>
<th>PSM</th>
<th>BRS</th>
<th>KOSS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year of employment</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UWES-9</td>
<td>0.18**</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SAVE-6</td>
<td>0.08</td>
<td>0.02</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PHQ-9</td>
<td>-0.16**</td>
<td>-0.30**</td>
<td>0.26**</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PSM</td>
<td>0.11</td>
<td>0.50**</td>
<td>0.11</td>
<td>-0.20**</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BRS</td>
<td>0.10</td>
<td>0.49**</td>
<td>-0.14*</td>
<td>-0.50**</td>
<td>0.22**</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>KOSS</td>
<td>-0.09</td>
<td>-0.58**</td>
<td>-0.11</td>
<td>0.12*</td>
<td>-0.34**</td>
<td>-0.25**</td>
<td>1.00</td>
</tr>
</tbody>
</table>

*p<0.05; **p<0.01. UWES-9, Nine-item Utrecht Work Engagement Scale; SAVE-6, Stress and Anxiety to Viral Epidemics–6 items; PHQ-9, Patient Health Questionnaire–9 items; PSM, Public Service Motivation; BRS, Brief Resilience Scale; KOSS, Korean Occupational Stress Scale

Table 3. Linear regression analysis expecting high level of work engagement or depression of public workers in COVID-19 pandemic era

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>Included parameter</th>
<th>Beta</th>
<th>p-value</th>
<th>Adjusted R²</th>
<th>F, p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>A) UWES-9</td>
<td>Year of employment</td>
<td>0.08</td>
<td>0.05</td>
<td>0.53</td>
<td>F=57.4, p&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>PHQ-9</td>
<td>-0.03</td>
<td>0.49</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SAVE-6</td>
<td>-0.02</td>
<td>0.61</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>KOSS</td>
<td>-0.40</td>
<td>&lt;0.001</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>PSM</td>
<td>0.28</td>
<td>&lt;0.001</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BRS</td>
<td>0.30</td>
<td>&lt;0.001</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B) PHQ-9</td>
<td>Year of employment</td>
<td>-0.12</td>
<td>0.02</td>
<td>0.30</td>
<td>F=22.1, p&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>UWES-9</td>
<td>-0.05</td>
<td>0.49</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SAVE-6</td>
<td>0.21</td>
<td>&lt;0.001</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>KOSS</td>
<td>-0.03</td>
<td>0.65</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>PSM</td>
<td>-0.10</td>
<td>0.08</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BRS</td>
<td>-0.42</td>
<td>&lt;0.001</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
of a study about the negative effects of stress and workload on work engagement of frontline nurses after the outbreak of COVID-19.43

High levels of work-related stress had a negative effect on work engagement and mediated partially in PSM and resilience. Based on the results of this study, which show the difference of the two groups categorized by the degree of work engagement, work-related stress, PSM, and resilience were more comparably distinctive. As revealed in previous studies, PSM tends to decrease under the influence of work stress and undermined PSM may lower work performance.23 In this work, PSM was highly correlated with work-related stress and work engagement compared to other parameters according to Spearman’s correlation analysis. Both the linear regression analysis and the mediating analysis showed that PSM could partially explain the relation between work-related stress and work engagement of public workers. Resilience was closely correlated with work-related stress and work engagement, partially mediating the relation between them. This result corresponds with an earlier study25 that suggested resilience as a mediating factor for explaining the relation between work stress and burnout during the non-pandemic era. There was no exact report regarding the relationship among the above-discussed factors for public workers during the pandemic. However, those relations were identically reproduced under the pandemic circumstances in our study, thereby suggesting that association between work-related stress and work engagement and mediating effect of PSM and resilience are not quite impacted by this extraordinary situation.

Although resilience and PSM were significant mediating factors, we should not overlook the fact that relationship between work-related stress and work engagement is mainly ex-

| Table 4. The results of direct, indirect, and total effects on mediation analysis |
|-----------------------------------------------|---------------|---------|---------|--------|---------|
| Effect                                      | Standardized estimator | S.E.   | Z-value | p     | 95% CI  |
| Work engagement                             |                |        |        |       |         |
| Direct effect                               |                |        |        |       |         |
| KOSS → UWES-9                               | -0.40          | 0.08   | -9.24  | <0.001| -0.90 to -0.58 |
| Indirect effect                             |                |        |        |       |         |
| KOSS → BRS → UWES-9                         | -0.08          | 0.02   | -3.91  | <0.001| -0.10 to -0.03 |
| KOSS → PSM → UWES-9                         | -0.10          | 0.02   | -4.61  | <0.001| -0.09 to -0.02 |
| Component                                   |                |        |        |       |         |
| KOSS → BRS                                  | -0.25          | 0.04   | -4.53  | <0.001| -0.28 to -0.11 |
| BRS → UWES-9                                | 0.32           | 0.10   | 7.87   | <0.001| 0.57 to 0.95  |
| KOSS → PSM                                  | -0.34          | 0.05   | -6.25  | <0.001| -0.42 to -0.22 |
| PSM → UWES-9                                | 0.30           | 0.08   | 6.94   | <0.001| 0.41 to 0.74  |
| Total effect                                |                |        |        |       |         |
| KOSS → UWES-9                               | -0.58          | 0.05   | -12.29 | <0.001| -0.67 to -0.49 |
| Depression                                  |                |        |        |       |         |
| Direct effect                               |                |        |        |       |         |
| SAVE-6 → PHQ-9                              | 0.21           | 0.05   | 4.16   | <0.001| -0.11 to -0.30 |
| Indirect effect                             |                |        |        |       |         |
| SAVE-6 → BRS → PHQ-9                        | 0.06           | 0.03   | 2.36   | 0.02  | 0.01 to 0.11  |
| SAVE-6 → PSM → PHQ-9                        | -0.01          | 0.01   | -1.49  | 0.14  | -0.03 to -0.004 |
| Component                                   |                |        |        |       |         |
| SAVE-6 → BRS                                | -0.14          | 0.06   | -2.45  | 0.014 | -0.28 to -0.03 |
| BRS → PHQ-9                                 | -0.45          | 0.06   | -9.01  | <0.001| -0.70 to -0.45 |
| SAVE-6 → PSM                                | 0.11           | 0.08   | 1.88   | 0.06  | 0.29 to 0.11  |
| PSM → PHQ-9                                 | -0.12          | 0.05   | -2.52  | 0.01  | -0.03 to -0.12 |
| Total effect                                |                |        |        |       |         |
| SAVE-6 → PHQ-9                              | 0.26           | 0.06   | 4.56   | <0.001| 0.15 to 0.36  |

KOSS, Korean Occupational Stress Scale; UWES-9, Nine-item Utrecht Work Engagement Scale; BRS, Brief Resilience Scale; PSM, Public Service Motivation; SAVE-6, Stress and Anxiety to Viral Epidemics–6 items; PHQ-9, Patient Health Questionnaire–9 items; S.E., standard error; CI, confidence interval
plained by the direct impact of work-related stress, rather than by partial mediating factors that reflect individual’s characteristics. Further research focusing on the comparison of strength of the direct impact of work-related stress on work engagement before and after the outbreak would be valuable to evaluate the actual effect of the pandemic on those relationships.

Year of employment was positively associated with work engagement; however, its value was not prominent, and it was not a significant factor to expect the level of work engagement. Longer work periods would reflect their improved ability in work performance; conversely, physical or mental fatigue from long-lasting work could decrease the concentration on the task. These divergent explanations might have resulted in a weak association between the two factors.

Viral anxiety did not have a significant effect on public workers’ work-related stress and work engagement, which was contrary to our expectation. South Korea has been recognized as an example to emulate in terms of promptly established preventive measures against the pandemic. Moreover, the survey was conducted a year after the outbreak, by which time systemic changes had already been settled. Therefore, anxiety reactions might not have had actual effects on public workers’ performance. However, it is noteworthy that participants’ scores on the SAVE-6 scale were comparably higher than in previous reports of other occupational groups. While acknowledging that a simple comparison may be inappropriate in the following case, we share that the average score on the SAVE-6 scale for healthcare workers at two big hospitals in South Korea was 14.4±4.5, whereas the average scores in case of the general South Korean population were 14.4±4.5 (male) and 14.7±4.6 (female), which were lower than our results. If public workers’ viral anxiety was substantially higher than other groups, consequent changes from anxiety to work engagement might not be apparent. Considering that viral anxiety was related with resilience and depression, which could further influence work engagement, it would be difficult to negate the possibility that viral anxiety might be a factor affecting work engagement.

Viral anxiety, depression, and resilience of public workers during the COVID-19 pandemic

Pandemic-induced psychological distress was reportedly closely linked with mood symptoms. According to a study about the mental health status of university students in Bangladesh, depressive symptoms were significantly expected by the perception of pandemic state and the concern for the severity of COVID-19. In this study, we observed that viral anxiety significantly influenced depressive symptoms, and resilience mediated this association. We had previously reported similar results among other samples of public workers. Similarly results were also reported among schoolteachers. Additionally, it has been noted that public servants’ anxiety is highly correlated with depression and resilience mediated the association between stress, anxiety, and depression during the non-pandemic years. Consequently, anxiety reaction, regardless of whether it was derived from the viral pandemic or not, contributes to depression and resilience acts as a mediator between them in case of public workers.

Resilience was strongly correlated with depression compared with other factors according to Pearson’s correlation analysis. Further, the effect of resilience on depression was more prominent in the mediating analysis, while the direct effect of viral anxiety was also significant. Though viral anxiety might lower the individual capacity to endure stress state, which eventually decreases the susceptibility to depression, resilience itself independently exerts its power to reduce the probability of having depressive symptoms, which accords to previous reports. Thus, caution should be exercised while
interpreting the results, as the role of personal vulnerability is also relevant.

Year of employment was negatively associated with depression, but the degree of the association was small, and it was not a meaningful factor to determine the level of work engagement. Work period was not related to viral anxiety and resilience, which were crucial underlying factors to determine the level of depression in our research. The individual capacity to endure stress and the lower level of anxiety might help one to work for longer periods, whereas other external factors such as a workload, relationships between coworkers, and organizational culture would exert negative influence on it. Moreover, despite the long career, an unfamiliar challenging state like the viral pandemic would be a difficult situation to endure. The year of employment is complicatedly determined through one's internal and external aspects; therefore, there is no single factor to explain the susceptibility to depression.

In this study, public workers’ PSM did not mediate the association between their viral anxiety and depression. PSM was negatively correlated with depression, but the correlation coefficient was not substantial. Further, PSM was not a significant factor to determine the level of depression although it had a negative relationship with depression. It has several different interpretations. First, there was an insignificant positive correlation between PSM and viral anxiety. We can speculate that as public workers’ viral anxiety increases because of aggravated social conditions under the pandemic, motivation to resolve the situation may also rise, because their duties primarily aim to promote public interest, not personal gain. A recent study explained that emotional disturbance due to a threatening situation, such as a pandemic, could provide the motivation to act. However, considering earlier findings that anxiety has a negative relationship with motivation, it would be reproduced in this situation where an emotionally unstable state along with viral anxiety might depress the workers’ morale. These bidirectional approaches would form a non-explicit conclusion that public workers’ PSM was not significantly affected by viral anxiety. Second, a comparatively higher level of PSM would be expected during the pandemic, if the initial response of the government was successful enough for the public to have confidence in the administration. As revealed in a study, public workers in China were highly motivated during the COVID-19 pandemic and their motivation had a positive correlation with public satisfaction and cooperation. In our research, the PSM measured one year after the outbreak would be higher than the usual state, considering that Korea was regarded as a model of credible national quarantine system during that period. In case public workers have already been encouraged by external factors during the pandemic, consequent changes in PSM due to viral anxiety might not be apparent.

This study has several limitations. First, the survey was conducted in April 2021—14 months after the pandemic’s outbreak, which might influence the results. Public workers might have already adjusted to the pandemic situation, and that might be the reason for the lack of mediation effect of PMS on the relationship between viral anxiety and depression. Moreover, the Korean government announced the “living with COVID-19” policy on November 1, 2021, as the country logged about 7,000 daily confirmed cases. The results can, therefore, vary depending on the severity of the pandemic situation. Second, we can speculate that the viral anxiety perceived by public workers can vary depending on their work role. Certain public workers might be in roles directly related with COVID-19, such as developing and executing the prevention policy, visiting or transferring infected persons, or cleaning and disinfecting. Similarly, others may be in roles not directly related with COVID-19. Third, this research was conducted via an anonymous online survey instead of face-to-face interviews to prevent the risk of a viral outbreak. However, the online survey might lead to a bias in the study design. Fourth, the relatively small sample size of the participants in this study can reduce its statistical power.

In conclusion, we observed that resilience and PSM partially mediate the effects of work-related stress on work engagement. Depression was influenced by COVID-19–induced viral anxiety, and resilience mediated this association. Especially in the relationship between viral anxiety and depression, resilience had a noticeable impact to lower the levels of depressed mood, which suggests that as a personal aspect, it might be one of the decisive factors to assess the susceptibility of depression. The results of this study might contribute to the development of a psychological support system for public workers in this pandemic era.

Availability of Data and Material
The datasets generated or analyzed during the study are available from the corresponding author on reasonable request.

Conflicts of Interest
Seockhoon Chung, a contributing editor of the Psychiatry Investigation, was not involved in the editorial evaluation or decision to publish this article. All remaining authors have declared no conflicts of interest.

Author Contributions