Investigating how individual differences influence responses to the COVID-19 crisis: The role of maladaptive and five-factor personality traits

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A B S T R A C T

Introduction: Coronavirus disease (COVID-19) pandemic impacted both the physical and psychological aspects of people's lives. Personality traits are one of the factors that explain the diverse responses to stressful situations. This study aimed to investigate whether five-factor and maladaptive personality traits are associated with depressive and anxiety symptoms, suicide risk, self-reported COVID-19 symptoms, and preventive behaviors during the COVID-19 pandemic, comprehensively.
Methods: We conducted an online survey among a representative sample of 1000 Koreans between May 8 to 13, 2020. Participants' five-factor and maladaptive personality traits were measured using the multidimensional personality inventory, the Bright and Dark Personality Inventory. COVID-19 symptoms, depressive and anxiety symptoms, suicide risk, and preventive behaviors were also measured.
Results: The results revealed that maladaptive personality traits (e.g., negative affectivity, detachment) had positive correlations with depressive and anxiety symptoms, suicide risk, and COVID-19 symptoms, and the five-factor personality traits (e.g., agreeableness, conscientiousness) had positive correlations with preventive behaviors.
Conclusion: Our findings extend the current understanding of the relationship between five-factor and maladaptive personality traits and responses to the COVID-19 pandemic. Longitudinal follow-up should further investigate the influence of personality traits on an individual's response to the COVID-19 pandemic.

1. Introduction

Due to the prolonged coronavirus disease (COVID-19) pandemic, people have experienced various crises and changes in their daily lives, and they have been exposed to a significant amount of mental health problems, including depression and anxiety (Qian & Yahara, 2020; Qiu et al., 2020; Wang et al., 2020). Such problems may result from the fear of being infected by COVID-19, a sense of isolation due to social distancing policies, and other socio-economic changes like unstable employment, job losses, and declining incomes during the quarantine (Bodrud-Doza et al., 2020; Brooks et al., 2020).

In an extremely stressful situation, individuals' reactions can vary (Wang et al., 2020), and personality traits are one of the factors that explain those differences (Afshar et al., 2015; Ebstrup et al., 2011; Segerstrom & O'Connor, 2012). The Five-Factor Model (FFM) is a well-known dimensional model of personality (McCrae & John, 1992). Considerable empirical research has proved the validity and utility of the dimensional model of personality (Widiger, 2017). According to the

FFM, personality traits interact with life circumstances, and can be adaptive or maladaptive in different contexts (e.g., marital status, employment; John et al., 2008; Ozer & Benet-Martinez, 2006). The adaptive and maladaptive variants in each of the FFM traits can be beneficial or harmful in certain situations. However, previous studies also indicate that the five-factor traits cannot fully explain pathological personality, although partial correlations have been found between them (Thomas et al., 2013; Watson et al., 2013). Therefore, for a more comprehensive understanding of one's personality structure and its role in responding in certain circumstances, both five-factor and maladaptive personality traits need to be measured.

In recent years, the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5; American Psychiatric Association [APA], 2013) proposed a dimensional trait model, the Alternative Model of Personality Disorder (AMPD). The AMPD comprises 25 traits organized within five domains (i.e., detachment, antagonism, disinhibition, psychoticism, and negative affectivity). The AMPD domains align with the FFM (APA, 2013; Gore & Widiger, 2013) and are also similar to the

domains of the Personality Psychopathology Five (PSY-5; Harkness et al., 2012) scales.

Several studies have demonstrated the association between personality and mental health outcomes. Regarding the five-factor personality traits, high neuroticism is strongly associated with depressive and anxiety symptoms (Bagby et al., 1995; Few et al., 2013; Hakulinen et al., 2015) and suicide risk (Enns et al., 2003; Kotov et al., 2010). A higher level of extraversion is negatively associated with depression (Clark et al., 1994; Farmer et al., 2002), anxiety (Stewart et al., 2004), and suicide risk (Blüml et al., 2013). Regarding maladaptive personality traits, disinhibition, detachment, and negative affectivity correlate positively with internalizing psychopathology (e.g., depression, anxiety; Few et al., 2013; Hyatt et al., 2020). High psychoticism is positively correlated with suicide risk (Lolas et al., 1991; Roy, 2003). Moreover, high levels of maladaptive personality traits are positively associated with emotional dysregulation, which in turn is related to symptoms of emotional disorders such as depression, anxiety, and suicidal ideation (Gratz et al., 2016; Pollock et al., 2016).

Furthermore, personality traits may be associated with physical health status during the COVID-19 pandemic. To the best of our knowledge, no study reports the associations between self-reported COVID-19 symptoms and personality traits. Increased self-reported COVID-19 symptoms may reflect vulnerability to actual physical symptoms and/or increased reports of symptoms. There are mixed results about the association between neuroticism, or negative affectivity, and physical health. Some studies reported that neuroticism was associated with increased reports of symptoms (Costa Jr & McCrae, 1987; Watson & Pennebaker, 1989). Other studies reported that neuroticism was associated with actual physical health outcomes (e.g., Smith & MacKenzie, 2006; Suls & Bunde, 2005).

Personality traits also influence individual responses to public health communication, compliance with social distancing, and personal hygiene during a pandemic (Abdelrahman, 2020; Blagov, 2020). Extraversion correlated negatively with preventive behaviors (e.g., social distancing; Muto et al., 2020). Conscientiousness, agreeableness, openness, and emotional stability were positively associated with health-related behaviors (Artistico et al., 2000; Malouff et al., 2006; Trobst et al., 2000).

Based on the previous findings, we hypothesized that:

H1. : Increased depressive and anxiety symptoms and suicide risk during COVID-19 are correlated with low extraversion and low emotional stability.

H2. : Increased depressive and anxiety symptoms and suicide risk during COVID-19 are correlated with high levels of maladaptive personality traits (i.e., detachment, egocentricism, disinhibition, psychoticism, and negative affectivity).

H3. : Increased self-reported COVID-19 symptoms are correlated with high negative affectivity.

H4. : Increased preventive behaviors during COVID-19 are correlated with low extraversion, high conscientiousness, high agreeableness, high openness, and high emotional stability.

Although previous studies have investigated the implications of personality traits in responses to a pandemic situation, most studies examined the influence of five-factor and maladaptive personality traits separately. Given that the effects of psychological interventions on mental health problems and subjective well-being vary depending on the personality (Castellanos & Conrad, 2006; Conrod, 2016; de Vibe et al., 2015), a better understanding of the role of personality traits in self-reported COVID-19 symptoms, mental health outcomes, and preventive behaviors should inform individualized psychological prevention or interventions.

2. Methods

2.1. Participants

All participants were recruited from an online survey company based on their age-group, sex, and geographical area. Participants received an email requesting participation in the survey. Those who agreed to provide online written informed consent responded to an online self-report questionnaire assessing their depressive and anxiety symptoms, suicide risk, self-reported COVID-19 symptoms, preventive behaviors during the COVID-19 pandemic, and personality traits. Responses were collected between May 8 to 13, 2020, and the study received approval from Korea university's institutional review board.

A total of 1000 participants (493 women, 49.3%) with a mean age of 44.27 years (SD = 13.02, range = 20–69) completed the survey and received online incentives from the survey company. Participants' mean years of education were 15.31 (SD = 1.99), and all participants were living in Korea at the time of the study.

2.2. Measures

2.2.1. Short Form of Bright and Dark Personality Inventory

The five-factor and maladaptive personality traits were assessed using the Short Form of the Bright and Dark Personality Inventory (BDPI-SF; Choi et al., in press). The BDPI-SF is a 33-item multidimensional personality inventory using a 4-point Likert scale (1 = *strongly disagree*; 4 = *strongly agree*). The five-factor personality traits include extraversion, agreeableness, conscientiousness, openness, and emotional stability, and the maladaptive personality traits include detachment, egocentricism, disinhibition, psychoticism, and negative affectivity (Choi et al., 2018; Lee et al., 2019). In the current study, Cronbach's alpha coefficient for the average of the five-factor personality subscales was 0.78, ranging from 0.46 for agreeableness to 0.75 for extraversion. Cronbach's alpha coefficient for the average of the maladaptive personality subscales was 0.94, ranging from 0.62 for attention difficulty to 0.77 for negative affectivity.

2.2.2. Mental Health Screening Tool for Depressive Disorders

Depressive symptoms were assessed using the Mental Health Screening Tool for Depressive disorders (MHS:D) (Choi et al., 2019; Yoon et al., 2018). The MHS:D is a 12-item self-report questionnaire using a 5-point Likert scale (0 = *never*; 4 = *most of the time*). The MHS:D exhibited a good internal consistency coefficient in this study (α = 0.94).

2.2.3. Mental Health Screening Tool for Anxiety Disorders

Anxiety symptoms were assessed using the Mental Health Screening Tool for Anxiety disorders (MHS:A) (Choi, Lee, & Choi, 2019; S.H. Kim et al., 2021; Y. Kim et al., 2018). The MHS:A is an 11-item self-report questionnaire using a 5-point Likert scale (0 = *never*; 4 = *most of the time*). The MHS:A exhibited a good internal consistency coefficient in this study (α = 0.96).

2.2.4. Mental Health Screening Tool for Suicide Risk

Suicide risk was assessed using the Mental Health Screening Tool for Suicide Risk (MHS:S) (Yoon et al., 2020). The MHS:S is a 4-item self-report questionnaire and measures suicide risk for the past two weeks using a 5-point Likert scale (0 = *never*; 4 = *always*) (Yoon et al., 2020). In the present study, Cronbach's alpha coefficient was 0.89.

2.2.5. COVID-19 Preventive Behavior Scale

Preventive behaviors during the COVID-19 pandemic were assessed using the COVID-19 Preventive Behavior Scale (CPBS). The CPBS is an 8-item questionnaire using a 5-point Likert scale (0 = *never*; 4 = *most of the time*). The previous study about the association between psychological factors and pandemic-related behaviors (Oosterhoff, 2020) and COVID-19 prevention and control guidelines in Korea were considered for item

development. In the present study, Cronbach's alpha coefficient was 0.88.

2.3. Data analysis

Descriptive statistics were assessed for participants' baseline characteristics. Pearson correlation analysis was conducted to examine the hypothesized relationships of personality traits with self-reported COVID-19 symptoms, depressive and anxiety symptoms, suicide risk, or preventive behaviors during the COVID-19 pandemic. Considering the type I errors that are due to multiple comparisons between variables in this study (Holm, 1979; Rice, 1989), we performed the Bonferroni correction, one of the conservative methods for adjusting p-values, and set p-values for all the analyses at 0.001. All analyses were performed using SPSS 25.0.

3. Results

3.1. Demographic characteristics

Demographic variables of participants are presented in Table 1. In the current study, 69.9% ($n = 696$) of participants were employed and 6.9% (n = 69) were unemployed; 36.2% participants ($n = 362$) were unmarried, 58% ($n = 580$) were married, and 3.2% ($n = 32$) were divorced; among participants except those who were unmarried, 89.6% ($n = 572$) were parents; 82.4% ($n = 663$) were working onsite or working from home at the time of the survey, while 8.6% (n = 69) were unemployed due to the COVID-19 outbreak; 18% ($n = 180$) indicated that their household monthly income had decreased during the COVID-19 pandemic; 12.9% participants ($n = 129$) experienced mild to critical COVID-19 symptoms.

3.2. Correlation analysis between personality traits, self-reported COVID-19 symptoms, depressive and anxiety symptoms, suicide risk, and preventive behaviors

Results of the correlation analysis between BDPI, self-reported

Table 1
Descriptive statistics of participants ($N = 1000$).

Variables	N/M	%/SD
Age (years)	44.3	13.0
Gender, female	493	49.3
Years of education	15.31	1.99
Occupation		
Full-time	614	61.4
Part-time	82	8.2
Unemployed	69	6.9
Others	235	23.5
Marital status		
Unmarried	362	36.2
Married	580	58.0
Divorced	32	3.2
Others	26	2.6
Number of children (n = 638)		
No children	66	10.3
1	178	27.9
2	333	52.2
3 or more	61	9.5
Employment status (current, n = 804)		
Work onsite	609	75.7
Work from home	54	6.7
Unemployed due to COVID-19 outbreak	69	8.6
Unemployed (before and after COVID-19 outbreak)	72	9.0
Self-reported severity of COVID-19 symptoms		
Never experienced	871	87.1
Mild	118	11.8
Severe	10	1.0
Critical	1	0.1

COVID-19 symptoms, MHS:D, MHS:A, MHS:S, and CPBS are presented in Table 2. All the five-factor personality traits, except for extraversion, correlated significantly with preventive behaviors; the effect size was small. In contrast, the correlations between the five-factor personality traits and self-reported COVID-19 symptoms were not significant, and a few personality traits had small associations with depressive and anxiety symptoms and suicide risk. Specifically, extraversion had a negative correlation with depression ($r = -0.175, p < .001$) and anxiety ($r = -0.158, p < .001$). Openness was positively correlated with anxiety ($r = 0.113, p < .001$). Each of the maladaptive personality traits had medium-to-large positive correlations with depressive and anxiety symptoms and suicide risk. Specifically, negative affectivity had more strong correlations with depression ($r = 0.568, p < .001$), anxiety ($r = 0.551, p < .001$), and suicide risk ($r = 0.387, p < .001$) than all the other traits. Small positive associations were shown between self-reported COVID-19 symptoms and maladaptive personality traits. Except for egocentricism, all the correlations with self-reported symptoms were significant at $p < .001$. There were no significant correlations between maladaptive personality traits and preventive behaviors.

4. Discussion

The current study comprehensively examined the relationship between the five-factor and maladaptive personality traits, self-reported COVID-19 symptoms, depressive and anxiety symptoms, suicide risk, and preventive behaviors during the COVID-19 pandemic among a representative sample of 1000 Koreans.

4.1. Associations between the five-factor and maladaptive personality traits, and mental health outcomes

As hypothesized, extraversion was negatively correlated with depressive and anxiety symptoms, replicating the results of previous studies on negative correlations with depression (Farmer et al., 2002; Saklofske et al., 1995) and anxiety (Stewart et al., 2004). Additionally, there was a negative association between extraversion and suicide risk; however, it was not significant. In contrast to our hypothesis, low emotional stability was not significantly associated with depression, anxiety, and suicidal symptoms, which is inconsistent with previous studies (Bagby et al., 1995; Enns et al., 2003; Few et al., 2013). Although generally described as low neuroticism, emotional stability measured using the BDPI was defined as the degree to which a person deals with his/her emotions in a way that shows one's maturity (i.e., emotional awareness, emotional acceptance, and emotional expression) and not just a tendency to experience negative emotions less frequently. Therefore, emotional stability in the present study may be similar but not identical to low neuroticism. Future research can examine the specific relationship between emotional stability and mental health outcomes.

Regarding the H2, maladaptive personality traits were positively correlated with depressive and anxiety symptoms and suicide risk, and the effect size was medium-to-large. Negative affectivity and detachment had strong correlations with depression, anxiety, and suicide risk. Individuals with high levels of neuroticism or negative affectivity are more inclined to react sensitively to signals that indicate punishment or threat (Blüml et al., 2013). Positive correlations between detachment, depressive and anxiety symptoms, and suicide risk can also be explained in a similar context. The cognitive vulnerabilities (e.g., anxiety vigilance) in individuals with high detachment may contribute to increasing the risk of mood and anxiety-related symptoms (Hong & Tan, 2020). The results of the current study were also consistent with the previous studies demonstrating that negative affectivity and detachment are positively correlated with internalizing psychopathology (e.g., depression, anxiety; Few et al., 2013; Hyatt et al., 2020; Longenecker et al., 2020; Mazza et al., 2020). Therefore, people who are high in negative affectivity and detachment might feel more vulnerable in dealing with

Table 2

Correlations of five-factor and maladaptive personality traits with self-reported COVID-19 symptoms, depressive and anxiety symptoms, suicide risk, and preventive health behavior ($N = 1000$).

Variable	Self-reported COVID-19 symptoms	MHS:D total score	MHS:A total score	MHS:S total score	CPBS Total score	CPBS Social distancing	CPBS Personal hygiene	M	SD
Five-factor personality traits									
Extraversion	−0.057	**−0.175*****	**−0.158*****	−0.100**	0.018	−0.032	0.073*	2.355	0.595
Agreeableness	−0.025	−0.091**	−0.066*	−0.074*	**0.203*****	**0.156*****	**0.218*****	2.822	0.481
Conscientiousness	−0.010	−0.064*	−0.016	−0.054	**0.253*****	**0.205*****	**0.259*****	3.072	0.545
Openness	0.060	0.072*	**0.113*****	0.051	**0.179*****	**0.131*****	**0.199*****	2.604	0.637
Emotional Stability	0.020	−0.071*	−0.042	−0.084**	**0.222*****	**0.158*****	**0.251*****	2.835	0.507
Maladaptive personality traits									
Detachment	**0.146*****	**0.481*****	**0.455*****	**0.353*****	0.081*	0.108**	0.032	1.959	0.645
Egocentrism	0.095**	**0.314*****	**0.292*****	**0.285*****	−0.090**	−0.074*	−0.091**	1.665	0.517
Disinhibition	**0.155*****	**0.444*****	**0.440*****	**0.283*****	0.006	0.039	−0.034	1.946	0.644
Psychoticism	**0.159*****	**0.463*****	**0.453*****	**0.381*****	−0.048	−0.005	−0.090**	1.616	0.561
Negative affectivity	**0.182*****	**0.568*****	**0.551*****	**0.387*****	0.056	0.088**	0.008	1.977	0.663
M	1.141	8.150	7.525	0.862	20.707	9.673	11.034		
SD	0.384	10.047	9.423	2.315	6.822	4.074	3.454		

Abbreviations: MHS:D, Mental Health Screening Tool for Depressive disorders; MHS:A, Mental Health Screening Tool for Anxiety disorders; MHS:S, Mental Health Screening Tool for Suicide Risk; CPBS, COVID-19 Preventive Behavior Scale.

Note: After adjusting *p*-values at 0.001 based on Bonferroni correction, significant correlations are presented in bold.

*** $p < .001$.
** $p < .01$.
* $p < .05$.

the COVID-19 situation.

High psychoticism was positively correlated with suicide risk, which is consistent with previous findings (Roy, 2003). Psychoticism refers to a disconnection from the real world and unusual thinking patterns (Holden et al., 2015). Hong and Tan (2020) argued that perceptual dysregulation, one of the major characteristics of psychoticism, is associated with anxiety sensitivity and dysfunctional attitudes. During the COVID-19 pandemic, individuals with high levels of psychoticism are likely to have maladaptive beliefs about their own experiences related to COVID-19. Those beliefs might get catastrophized and may lead to an increased vulnerability to depressive and anxiety symptoms and suicide risk.

The associations between egocentrism, disinhibition, depressive and anxiety symptoms, and suicide risk can be explained by emotional dysregulation. Emotional dysregulation can be observed in individuals with high maladaptive personality traits (Pollock et al., 2016). Emotional dysregulation contributes to the development of various psychological disorders, including emotional disorders such as anxiety disorders and depression (Abdi & Pak, 2019; Brandt et al., 2013). Therefore, it is likely that high levels of maladaptive personality traits are positively associated with symptoms of emotional disorders such as depression, anxiety, aggression, and suicidal ideation (Gratz et al., 2016). In pandemic situations, people are required to control their urges and actions more. However, individuals with high disinhibition (e.g., impulsivity, distractibility) or high egocentrism (e.g., insensitive toward other's needs and emotions, act in one's own interests and satisfaction) are more likely to regulate their own needs and actions maladaptively (Abdi & Pak, 2019). Specifically, high egocentrism is also associated with restriction on emotional regulation strategies; therefore, people with high egocentrism cannot respond to negative interpersonal events properly (Pollock et al., 2016). Eventually, the maladaptive regulation system may result in negative affectivity such as anxiety, depression, and anger. A previous study also reported that there are medium-to-large correlations between disinhibition and depression as well as anxiety (Hyatt et al., 2020).

4.2. Associations between the five-factor and maladaptive personality traits, and self-reported COVID-19 symptoms

As hypothesized, negative affectivity correlated positively with self-reported COVID-19 symptoms. Additionally, except for egocentrism, there were weak positive associations between other maladaptive personality traits and self-reported COVID-19 symptoms. In the current study, the participants were required to report whether they had experienced COVID-19 symptoms (e.g., fever, chills, muscle aches, etc.) and the severity of the symptoms. Therefore, the participants' responses may reflect not only the existence of actual symptoms but may also include subjective feelings of one's physical health status. Therefore, the relationship between negative affectivity and self-reported COVID-19 symptoms in the present study is consistent with the findings of the previous research that negative affectivity correlates with increased reports of symptoms (Costa Jr & McCrae, 1987). Regarding other maladaptive traits, previous findings indicate that disinhibition, detachment, and psychoticism are associated with cognitive vulnerabilities (Hong & Tan, 2020), emotional dysregulation (Pollock et al., 2016), and greater perception of stressors (Compton et al., 2008), which may increase the vulnerability to physical health in stressful circumstances (e. g., the COVID-19 pandemic). Therefore, future research should examine the duration and frequency of COVID-19 symptoms to assess the relationship between the maladaptive traits and symptoms.

4.3. Associations between the five-factor and maladaptive personality traits, and preventive behaviors

As hypothesized, all the five-factor personality traits were significantly correlated with preventive behaviors, but the effect size was small. Agreeableness is characterized by the pursuit of harmonious relationships and prosocial behaviors or attitudes. Conscientiousness is characterized by responsibility, which is a tendency to value and abide by social rules. Kals (2001) argued that preventive health behaviors and its purpose are not only for one's health but also for the general public, and further include responsibility and behavioral decisions to reduce health risks across society. Therefore, in a pandemic situation, following preventive behavior policy can be considered as a type of prosocial

behavior as well as self-protection. Considering this, high agreeableness and high conscientiousness could relate to more engagement in preventive behaviors. Emotional stability is associated with health-related behaviors (Artistico et al., 2000). As preventive behavior is essentially a health-related behavior, emotional stability was found to be positively correlated with preventive behaviors in the current study.

Interestingly, openness was positively associated with both preventive behaviors and a negative mental health status (i.e., depressive and anxiety symptoms and suicide risk). According to Qian and Yahara (2020), openness is a significant predictor of stress, epidemic consciousness, as well as preventive behavior. Trobst et al. (2000) suggested that openness may facilitate health behaviors by improving risk perceptions. Thus, openness is likely to induce healthy behaviors and elevate depressive and anxiety symptoms and suicide risk simultaneously.

In contrast with our hypothesis, extraversion was not associated with preventive behaviors, which is inconsistent with previous studies indicating that extraversion was negatively correlated with preventive behaviors (e.g., social distancing; Muto et al., 2020). The inconsistent results in preventive behaviors may come from different sample characteristics, timing of data collection, and cultures (e.g., Koreans vs. Japanese). In Muto et al. (2020), respondents of the study were Japanese, and the time of data collection was at the end of March 2020 (the coronavirus infection was sharply increasing) as compared to May 2020 in the current study (the rate of coronavirus infection had been decreasing since March). In Korea, at the time of data collection, the COVID-19 protection policy (e.g., social distancing, wearing facial masks, and so on) was well received and stably applied by the public, and preventive behaviors may not be influenced by extroversion.

4.4. Limitations and future research

Several limitations of the current study should be noted. First, since the data was collected in Korea during the second wave of the COVID-19 pandemic, the results are not generalizable to different countries or other pandemic situations and times. Second, considering that the current study was conducted in May (the relatively early phase of the COVID-19 pandemic in Korea), the current findings may reflect the short-term relationships between personality traits and other variables. Additionally, although we performed the Bonferroni correction to avoid a conflation of correlations between personality traits and other variables, there may be cross-loadings between some of these instruments, and the associations may be overstated. For example, individuals who already experience depressive and anxiety symptoms may report high levels of maladaptive personality traits. For the baseline assessment of variables (e.g., personality traits, history of depressive and/or anxiety disorders), longitudinal research should be conducted to investigate the causal role of personality traits (i.e., risk factor, protective factor) in individuals' responses during the COVID-19 pandemic.

5. Conclusion

The current study comprehensively examined the relationship between personality traits, self-reported COVID-19 symptoms, depressive and anxiety symptoms, suicide risk, and preventive behaviors during the COVID-19 pandemic. The present study indicates the importance of considering both five-factor and maladaptive personality traits to fully understand the association between one's personality and responses to a highly stressful situation (i.e., the COVID-19 pandemic). Our findings extend the current understanding of the relationship between personality traits and responses to a stressful situation.

Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

CRediT authorship contribution statement

Yeoul Han: Conceptualization, Methodology, Investigation, Formal analysis, Data curation, Writing – original draft, Writing – review & editing. **Jihee Jang:** Methodology, Investigation, Data curation, Writing – original draft, Writing – review & editing. **Eunsil Cho:** Methodology, Investigation, Writing – original draft, Writing – review & editing. **Kee-Hong Choi:** Conceptualization, Methodology, Writing – review & editing, Supervision, Project administration, Funding acquisition.

Declaration of competing interest

We have no known declaration of interest to disclose.

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