



A study on the mental health of students at a medical school during COVID-19 outbreak: a retrospective study

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Background: In this study, the degree of anxiety, depression, and stress caused by coronavirus disease 2019 (COVID-19) was identified, as well as the need for psychological prevention measures among medical students in the Daegu region that was designated the first special disaster area due to the spread of COVID-19.

Methods: The subjects of this study were 318 medical students in Daegu who voluntarily participated in an online test using the Hospital Anxiety and Depression Scale and Impact of Event Scale-Revised Korean version. As a result of the test, risk students received immediate telephone counseling, and the effect of this telephone counseling was analyzed.

Results: There were no differences in depression, anxiety, or stress according to gender and grade. As a result of immediate telephone counseling for risk students, significant differences were found in depression, anxiety, and stress, and the counseling was found to be effective.

Conclusion: For medical students who are easily exposed to stress, the importance of psychological prevention measures and effectiveness of non-face-to-face counseling should be recognized. In the field of medical education, we must do our best to build a system that can be used immediately at the appropriate time for these programs.

Keywords: Counseling; COVID-19; Medical education; Medical students; Mental health

Introduction

In 2020, the world had fallen into a pandemic of chaos and fear due to coronavirus disease 2019 (COVID-19); in particular, travel to Korea was restricted by almost all countries due to the explosion in the number of confirmed cases since the first COVID-19 outbreak

in February 2020. Specifically, Daegu and Gyeongsangbuk-do (Gyeongbuk) accounted for 82% of Korea's confirmed cases at the end of March 2020 [1].

It is well known that pandemics of new infectious diseases can cause an emotional crisis for the general public. During the Middle East respiratory syndrome epidemic in 2015, the general

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public was reported to have significant fear and emotional distress [2]. Psychological problems such as fear, anxiety, and depression related to the COVID-19 pandemic have also been described [3].

The COVID-19 pandemic has been reported to cause emotional problems, such as depression, anxiety, and fear, in college students [4]. These psychological and emotional burdens are caused by sudden changes in the educational environment and uncertainty about the future, such as future employment [5-7].

Medical school students have also encountered the psychological and emotional problems caused by the COVID-19 pandemic. Medical students have self-recognized symptoms caused by the COVID-19 pandemic and have been diagnosed with physical or mental illnesses. Thus, it has been reported that negative effects such as fear and anxiety during the COVID-19 pandemic affect mental health [8].

Medical school students experienced a lot of stress even before the COVID-19 pandemic due to the burdens of excessive learning, test scores, maintaining grades, and clinical practice [9]. Academic exhaustion, which manifests as fatigue, frustration, stress, mental exhaustion, helplessness, and cynical attitudes due to excessive study, can also cause mental health problems such as severe maladjustment and depression, suicide, and dropping out of medical school [10,11]. In other words, medical college education is recognized as an environment that causes depression, anxiety, and extreme stress for medical students and is related to mental health problems such as depression, anxiety, and exhaustion [12-14].

As such, medical school students were usually complaining of many emotional problems. Sudden changes in the educational and living environment due to the COVID-19 pandemic can increase psychological problems, including stress, for medical school students. Therefore, during the crisis caused by the COVID-19 pandemic, it was urgent to identify the psychological difficulties of medical school students early and take appropriate measures accordingly. In particular, the need for psychological prevention measures for medical school students in Daegu and Gyeongbuk, which were first declared special disaster areas in early 2020, was even more urgent. Immediate counseling of students in such crisis situations can help with psychological prevention measures [15].

This study aimed to identify anxiety, depression, and stress caused by COVID-19 in medical students in Daegu, which experienced the first special disaster area due to the spread of COVID-19 in April 2020, and to confirm the need for psychological prevention measures.

Methods

Ethical statements: Prior to the test, a consent form was provided, and the online test was designed so that only students who agreed to voluntarily participate could respond. Participants in the study were allowed to stop the test immediately if they no longer wanted to participate in the survey, and these matters were sufficiently explained and announced. This study was approved by the Institutional Review Board (IRB) of Yeungnam University Hospital (IRB No: YUMC 2020070 54-HE002).

1. Subject of study and data collection

This study measured depression, anxiety, and stress caused by COVID-19 in 464 students in six grades from first-grade premedical school to fourth-grade medical school in Daegu, where a special disaster area was declared due to a rapid increase in cases early in the COVID-19 pandemic. Among the medical students, 68 risk groups were selected by analyzing the results of 318 people who voluntarily agreed to participate in the study, and telephone counseling was conducted for the selected students. In addition, to confirm the psychological changes in students before and after the phone counseling, 47 students who participated in the counseling were assessed for depression, anxiety, and stress using the same test paper. Telephone counseling was also conducted for students who voluntarily agreed to participate in the study.

As a result, students with an anxiety (Hospital Anxiety and Depression Scale-Anxiety [HADS-A]) score of 8 or higher, depression (HADS-Depression [HADS-D]) score of 8 or higher, or stress (Impact of Event Scale-Revised Korean version [IES-R-K]) score of 25 or higher were selected as risk groups. Among the 318 students who responded, all students who exceeded the cutoff on one of the above scales were selected as risk groups and telephone counseling was conducted.

The first test was conducted from April 7 to 17, 2020, and telephone consultations were conducted from April 20 to May 1, 2020. Two weeks after the telephone consultation, anxiety (HADS-A), depression (HADS-D), and stress (IES-R-K) were assessed.

Semi-structured counseling was conducted by a research professor at the student counseling center of the target school, who had a professional counseling license. The consultation involved questions about the client's mood, living conditions, school class participation, and difficulties according to the COVID-19 situation; additional questions were asked according to the answers received.

A summary of the research subjects and data collection process is shown in Fig. 1.

2. Instruments

1) Anxiety and depression

The HADS was used to measure the degree of anxiety and depression caused by the COVID-19 pandemic. The HADS consists of seven odd-numbered questions measuring anxiety (HADS-A) and seven even-numbered questions measuring depression (HADS-D). The reliability (Cronbach alpha) of each scale is 0.89 (HADS-A) and 0.83 (HADS-D) [16]. The response to each question uses a scale: “not at all” (0 points), “sometimes yes” (1 point), “often yes” (2 points), and “almost yes” (3 points). A total score of less than 8 points means no symptoms of anxiety and depression; 8 points or higher means symptoms of anxiety and depression [16].

2) Stress

To measure the stress caused by the COVID-19 pandemic, IES-R-K [17] was used, which standardized the Impact of Event Scale developed by Weiss and Marmar [18] in 1997. The reliability (Cronbach alpha) of this test tool is 0.83 [17]. This test tool con-

sists of 22 questions on a self-reporting scale of trauma-related symptoms, with the response to each question being “not at all” (0 points), “rare” (1 point), “sometimes” (2 points), “frequently” (3 points), or “very often” (4 points). The scale also consists of sub-guidelines for hyperarousal, avoidance, intrusion, and sleep and numbness. Less than 24 points on the IES-R-K are considered a stress-free state, and 25 points or more are considered a stress risk group [18].

3. Statistical analysis

The collected data were analyzed using IBM SPSS ver. 23.0 (IBM Corp., Armonk, NY, USA). Independent samples *t*-tests were conducted to confirm the differences in anxiety, depression, and stress according to gender, and a one-way analysis of variance (ANOVA) was conducted to confirm the differences according to grade. Regarding the results of the secondary test for the risk group, response sample *t*-tests before and after counseling and Wilcoxon signed-rank tests were conducted.

Results

1. Participants or subjects

A total of 318 students responded to the test, with 61 and 45 stu-

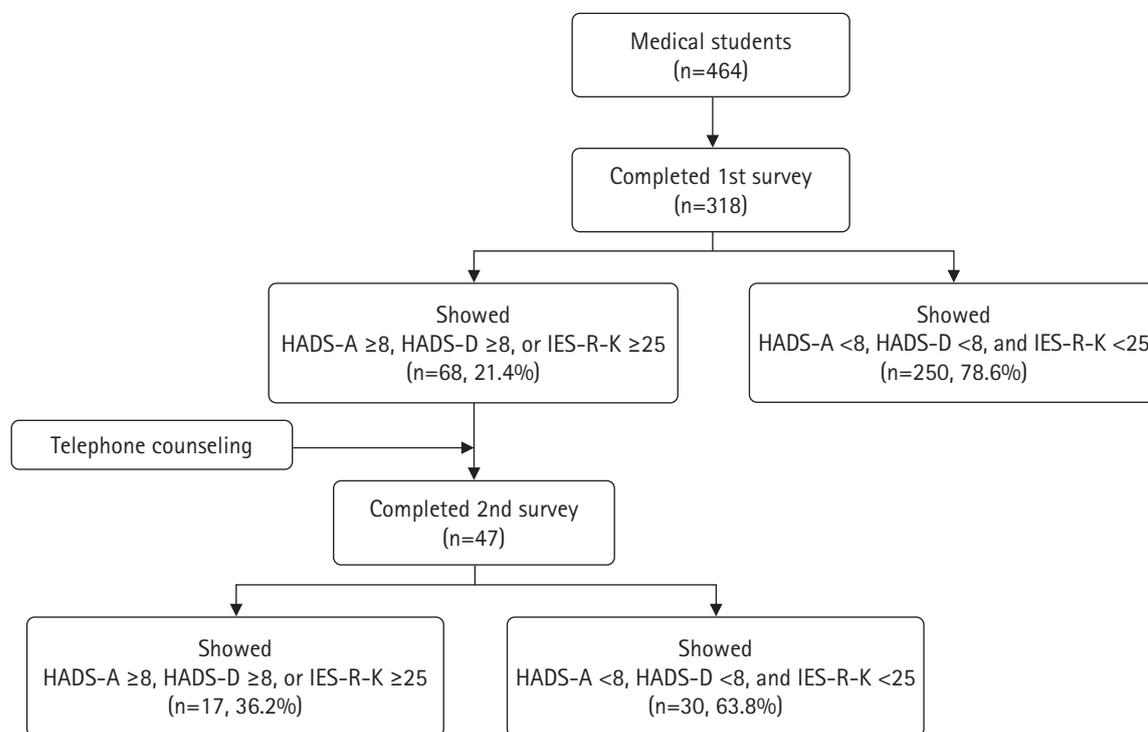


Fig. 1. Study subjects selection and data collection diagram. HADS-A, Hospital Anxiety and Depression Scale-Anxiety; HADS-D, Hospital Anxiety and Depression Scale-Depression; IES-R-K, Impact of Event Scale-Revised Korean version.

dents in the first and second grade of premedical school, respectively; and 54, 69, 32, and 57 in the first, second, third, and fourth grade of medical school, respectively. The gender distribution was 194 males (61.0%) and 124 females (39.0%) (Table 1).

2. Differences in depression, anxiety, and stress by gender

To confirm the differences according to gender, an independent

samples *t*-test was conducted using gender as an independent variable and depression, anxiety, and stress as dependent variables. Depression, anxiety, and stress were not all statistically significant according to gender. However, as a result of the independent samples *t*-test with gender as an independent variable and hyperarousal, avoidance, intrusion, and sleep and numbness, which were stress subgroups, as dependent variables, it was confirmed that female students were significantly higher than male students in hyperarousal ($t = -2.33, p < 0.05$) (Table 2).

Table 1. Gender and grade distribution of subjects (n=318)

Course	No. of medical students (%)		
	Male	Female	Total
Premedical course			
Grade 1	40 (12.6)	21 (6.6)	61 (19.2)
Grade 2	25 (7.9)	20 (6.3)	45 (14.2)
Medical course			
Grade 1	32 (10.1)	22 (7.0)	54 (17.1)
Grade 2	40 (12.6)	29 (9.1)	69 (21.7)
Grade 3	14 (4.4)	18 (5.7)	32 (10.1)
Grade 4	43 (13.5)	14 (4.4)	57 (17.9)
Total	194 (61.0)	124 (39.0)	318 (100)

3. Differences in depression, anxiety, and stress by grade

To check for differences in depression, anxiety, and stress according to grade, a one-way ANOVA was performed with grade as an independent variable and depression, anxiety, and stress as dependent variables. There were no statistically significant differences according to grade in depression, anxiety, and stress (Table 3).

4. Risk group selection

Students with anxiety (HADS-A) scores of 8 or higher, depression

Table 2. Differences in depression, anxiety, and stress by gender

Variable	Male (n = 194)	Female (n = 124)	Total (n = 318)	<i>t</i> -value
Depression	4.56 ± 2.90	4.71 ± 3.15	4.62 ± 3.00	-0.44
Anxiety	3.06 ± 2.97	3.33 ± 2.55	3.16 ± 2.82	-0.85
Stress	4.15 ± 7.70	5.66 ± 6.98	4.74 ± 7.52	-1.76
Hyperarousal	1.07 ± 2.10	1.63 ± 2.05	1.29 ± 2.10	-2.33*
Intrusion	1.03 ± 2.25	1.48 ± 2.47	1.21 ± 2.35	-1.68
Avoidance	0.97 ± 2.30	1.45 ± 2.38	1.16 ± 2.34	-1.78
Sleep problem	1.08 ± 1.85	1.10 ± 1.45	1.08 ± 1.70	-0.10

Values are presented as mean ± standard deviation.

Depression was assessed with Hospital Anxiety and Depression Scale-Depression. Anxiety was assessed with Hospital Anxiety and Depression Scale-Anxiety. Stress, hyperarousal, intrusion, avoidance, and sleep problem were assessed with Impact of Event Scale-Revised Korean version.

* $p < 0.05$.

Table 3. Differences in depression, anxiety, and stress by grade

Variable	Premedical course		Medical course				<i>p</i> -value
	Grade 1 (n = 61)	Grade 2 (n = 45)	Grade 1 (n = 54)	Grade 2 (n = 69)	Grade 3 (n = 32)	Grade 4 (n = 57)	
Depression	4.72 ± 3.02	4.42 ± 2.31	4.96 ± 2.96	4.06 ± 3.11	4.69 ± 3.04	4.96 ± 3.32	0.83
Anxiety	3.16 ± 3.09	3.16 ± 2.88	3.41 ± 2.63	2.64 ± 2.60	3.28 ± 2.36	3.51 ± 3.13	0.74
Stress	4.87 ± 7.86	4.44 ± 6.09	4.89 ± 8.57	4.41 ± 8.27	4.66 ± 4.99	5.16 ± 7.23	0.09
Hyperarousal	1.31 ± 2.38	1.09 ± 1.87	1.13 ± 1.79	1.25 ± 2.27	1.53 ± 1.85	1.49 ± 2.17	0.34
Intrusion	1.26 ± 2.52	1.20 ± 1.96	1.33 ± 3.00	0.99 ± 2.29	1.44 ± 2.14	1.18 ± 1.95	0.22
Avoidance	1.15 ± 2.35	1.11 ± 2.19	1.46 ± 2.87	1.10 ± 2.49	0.97 ± 1.26	1.11 ± 2.22	0.24
Sleep problem	1.15 ± 1.95	1.04 ± 1.17	0.96 ± 1.50	1.07 ± 1.98	0.72 ± 1.20	1.39 ± 1.83	0.73

Values are presented as mean ± standard deviation.

Depression was assessed with Hospital Anxiety and Depression Scale-Depression. Anxiety was assessed with Hospital Anxiety and Depression Scale-Anxiety. Stress, hyperarousal, intrusion, avoidance, and sleep problem were assessed with Impact of Event Scale-Revised Korean version.

(HADS-D) scores of 8 or higher, and stress (IES-R-K) scores of 25 or higher were selected as risk groups, and among the 318 students who responded, all students who exceeded the cutoff point on at least one of the three scales were selected as risk groups. The total number of students in the risk group was 68 (21.4%), and the risk groups for depression, anxiety, and stress contained 47, 26, and 19 students, respectively (Table 4).

5. Differences in depression, anxiety, and stress before and after telephone counseling in risk groups

Of the 68 students who received telephone counseling classified as a risk group in the first test, 47 (69.1%) who agreed to participate in the study were assessed for the effect of telephone counseling. Of the 47 students who agreed to participate in the study, 32, 24, and 9 students were at risk of depression, anxiety, and stress, respectively, and the same depression, anxiety, and stress tests were conducted on them to verify the differences before and after phone counseling. An independent samples *t*-test was performed for depression, and a Wilcoxon signed-rank test was performed for anxiety and stress. As a result, a significant difference was found in depression, anxiety, and stress ($p < 0.05$).

The depression index changed significantly from an average of 9.78 before counseling to 4.38 after counseling ($p < 0.01$),

and the number of students in the risk group also decreased from 32 to 7. The average anxiety index decreased significantly from 9.33 before counseling to 5.33 after counseling ($p < 0.05$), and the risk group number decreased from 24 to 11. The average total stress index was also significantly lowered from 40.33 to 13.56 ($p < 0.05$), and the risk group was also reduced from nine to four students (Table 5).

Discussion

The purpose of this study was to analyze the psychological status of depression, anxiety, and stress among medical school students in Daegu and Gyeongbuk, designated as special disaster areas in Korea due to the rapid spread of COVID-19. Another purpose was to confirm the psychological prevention measures effect of conducting telephone counseling for students in need based on the results. To this end, a psychological survey was conducted on students in a medical school in Daegu, and telephone counseling was conducted for those who requested it. Suggestions based on the research results are as follows. The results showed that medical school students experienced anxiety, depression, and stress due to COVID-19, and immediate telephone counseling helped them psychologically quarantine themselves. Through this study, the fol-

Table 4. Distribution of students in the risk group (n=47)

Variable	No. of medical students (%)					
	Premedical course		Medical course			
	Grade 1	Grade 2	Grade 1	Grade 2	Grade 3	Grade 4
Depression, HADS-D ≥ 8	9 (2.8)	3 (0.9)	12 (3.8)	9 (2.8)	6 (1.9)	8 (2.5)
Anxiety, HADS-A ≥ 8	5 (1.6)	3 (0.9)	6 (1.9)	3 (0.9)	2 (0.6)	7 (2.2)
Stress, IES-R-K ≥ 25	2 (0.6)	3 (0.9)	5 (1.6)	3 (0.9)	1 (0.3)	5 (1.6)

HADS, Hospital Anxiety and Depression Scale; HADS-D, HADS-Depression; HADS-A, HADS-Anxiety; IES-R-K, Impact of Event Scale-Revised Korean version.

Table 5. Differences in depression, anxiety, and stress before and after telephone counseling

Variable	Risk group (n)	Pretest	Posttest	Negative rank		Positive rank		Z
				Avg rank	Rank sum	Avg rank	Rank sum	
Depression ^{a)}	32	9.78 ± 2.20	4.38 ± 3.85					
Anxiety	24	9.33 ± 1.66	5.33 ± 3.48	13	294	3	6	-4.13*
Stress	9	40.33 ± 15.81	13.56 ± 17.43	5	45	0	0	-2.68**
Hyperarousal	-	8.78 ± 4.09	2.33 ± 2.92	5	45	0	0	-2.68**
Intrusion	-	11.11 ± 5.51	2.78 ± 3.42	5	45	0	0	-2.70**
Avoidance	-	12.56 ± 4.16	5.89 ± 7.75	5	45	0	0	-2.68**
Sleep problem	-	7.89 ± 3.10	2.56 ± 3.40	5	45	0	0	-2.71**

Values are presented as number or mean ± standard deviation.

Avg, average.

^{a)} $t = 9.08^*$; * $p < 0.01$, ** $p < 0.05$.

lowing conclusions and suggestions were made.

First, it is necessary to actively introduce and implement counseling programs for psychological prevention measures to help mitigate stress, anxiety, and depression among medical school students. In addition to face-to-face counseling, remote counseling programs should be implemented at all times, even during the COVID-19 pandemic.

The psychological difficulties faced by medical school students are well known [19,20]. Medical students usually experience psychological difficulties. In particular, medical students have more psychological difficulties than premedical students because the former have little personal time owing to full-fledged medical learning [19,20]. These psychological difficulties persisted during the COVID-19 pandemic. Jo et al. [21] reported that medical students at risk of depression, anxiety, and stress due to COVID-19 infection complained of psychological difficulties at a similar rate as frontline medical workers at the same university hospital during the same period.

Through this study, it was confirmed that students in our medical school have a psychological burden similar to that of medical workers at the forefront of the COVID-19 pandemic. Of course, an increase in stress and depression among medical students due to the COVID-19 pandemic has been reported not only in Korea but also in all countries around the world [22,23]. As such, along with the spread of awareness of the importance of the mental health of medical school students, it is necessary to quickly identify abnormal symptoms and prepare specific and practical measures to solve them.

Second, a counseling program should be established that can be applied immediately at the most appropriate time. Regardless of how good the established programs and education systems are, if the most appropriate timing of their application is missed, their effectiveness will be halved.

It is known that clients in crisis situations need counseling, and counselors' immediacy through counseling is important for clients suffering from psychological difficulties and can make positive long-term changes [24]. In addition, it has been reported that by immediately intervening in the client's crisis, the client is more open to his/her problems, unresolved problems are corrected through counseling, and the client's psychological distress improves [15].

On March 15, 2020, the Daegu and Gyeongbuk regions were declared special disaster zones. At the end of March 2020, 82% of confirmed cases in Korea occurred in Daegu and Gyeongbuk. In this study, the test was conducted from April 7 to 17, immediately after that period, and phone counseling was started 3 days later. Psychological distress, such as psychological anxiety, depression,

and stress among medical students, was improved by intervention with immediate telephone counseling in a pandemic crisis situation.

Third, this study confirmed that the emotional risk caused by the COVID-19 outbreak was helpful in the psychological prevention measures of students through telephone counseling only. In previous studies, telephone counseling has been shown to be effective in the COVID-19 situation. For college students, the net function of telephone counseling was analyzed in terms of environmental and psychological comfort. Specifically, it was reported that receiving counseling in a familiar and comfortable place, non-exposure, confidentiality, and being able to talk without being face-to-face were advantageous [25]. It has been reported that both college students and patients at medical institutions were satisfied with temporarily permitted telephone counseling due to COVID-19 [26]. Judging from these results, it can be seen that in cases where face-to-face counseling is not possible due to a sudden epidemic of an infectious disease, such as in a declared disaster area, a similar effect can be obtained only by telephone counseling. Therefore, we think that medical schools must have a face-to-face or remote counseling program in which students can receive counseling at all times for various psychological prevention measures.

Finally, medical schools need to prepare various types of remote online education systems that can minimize the physical and psychological burdens of being exposed to the actual curriculum.

According to the results of this study, depression, anxiety, and stress could not be differentiated based on the medical school grade, including the premedical department, but previous studies have shown that medical students experience higher stress levels than premedical students [19,20]. In other words, in the present study, premedical students experienced as many psychological difficulties as the medical students. This exemplifies the psychological difficulties caused by university life that is only conducted remotely, in which there was no previous campus life.

According to Mheidly et al. [27], one of the biggest changes with the COVID-19 pandemic was a change in communication, which appeared most rapidly in the education field. As most previous face-to-face learning rapidly shifted to online learning, the long-term use of smart devices was found to cause psychological and emotional problems. Prolonged exposure to tablets and smart devices increases stress and anxiety, and communication-related stressors, along with other COVID-19-related stressors, may eventually lead to burnout.

Medical students are no exception to these factors. Isolated digital learning of medical students has been reported to have detrimental effects on mental health, including acute stress disorder, ir-

ritability, insomnia, emotional distress, depressive symptoms, fear and panic, anxiety and stress, and mood disorders, all of which pose significant risks [28]. Medical school students who took digital learning isolated in COVID-19 are blocked from external exposure and experience learning in a personal space, so they can experience psychological difficulties just as much as students who practice clinical practice at the forefront of COVID-19 medical field. The above results show that because of the sudden changes in the educational environment, online-centered remote education acts as a significant stressor for students who spend a lot of their day learning in private spaces, including homes, through smart equipment.

Therefore, medical schools should prepare for various types of education in preparation for sudden situations based on their experiences with COVID-19. A situation may arise where face-to-face classes are abruptly suspended and there is no choice but to switch to remote classes.

The limitations of this study are that it did not compare data on (1) classification according to student personality traits or types of adaptation, (2) classification according to preferred learning methods, or (3) psychological states before the COVID-19 pandemic.

In conclusion, in this post-COVID-19, new normal, rapidly changing era, medical schools need to develop the ability to adapt to change [29] and recognize the importance of psychological prevention measures and the effectiveness of remote counseling for medical students who are easily exposed to stress. In the field of medical education, we should do our best to establish a system in which these programs can be applied immediately at the appropriate time. In the future, we think that more institutional participation and long-term tracking are also needed.

Notes

Conflicts of interest

No potential conflict of interest relevant to this article was reported.

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Author contributions

Conceptualization: all authors; Data curation: HJP, JYH, YHL; Formal analysis: Funding acquisition, Validation: YRK, HJP, YHL; Methodology: HJP, YHL; Project administration: YRK, YHL; Visualization: HJP; Investigation: BHK, JYH, YHL; Resources: BHK; Supervision: YRK, YHL; Writing-original draft: YRK, JYH;

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