Archives of Business Research – Vol. 10, No. 11
Publication Date: November 25, 2022
DOI:10.14738/abr.1011.13510.
Abdullah, M., Omar, M., & Bahardin, T. I. (2022). Predictive Analytics of Mental Health Problems Among College Students in the Covid-19 Pandemic. Archives of Business Research, 10(11). 301-318.

Predictive Analytics of Mental Health Problems Among College Students in the Covid-19 Pandemic

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ABSTRACT

Covid-19 pandemic has brought into focus the mental health of various segments of society. This paper presents an empirical study on mental health of college students due to the specific situations caused by the pandemic. A particular focus is on the effects of three stressors, namely, academic workload, separation from school, and fears of contagion among the college students. This initiative was a follow-up of the study by Yang et al. (2021) who proposed a research model that evaluates the impacts of these stressors on perceived stress which subsequently affects the mental health of the students. Using the data collected by Yang et al. (2021), an alternative predictive analytics approach, i.e., Partial Least Squares Structural Equation Modelling (PLS-SEM), was adopted to re-evaluate the research model. This has produced an improvement over the results of Confirmatory Factor Analysis (CFA) adopted by Yang et al. (2021), particularly in the test for the significance of correlation between academic workload and mental health. While the use of PLS-SEM that allowed for strategic refinements of the model produced a significant correlation between the two important constructs, the CFA failed to obtain a similar result. All the other significant correlations between the stressors and mental health and correlation between the mediating factor, the perceived stress, and mental health were also established using the PLS-SEM approach.

Keywords: Mental Health, College Students Stressors, Covid-19 Pandemic, PLS-SEM.

INTRODUCTION

The new global phenomenon, Covid-19 pandemic, has adversely affected the mental health of various segments of society. The Covid-19 pandemic has alarming implications for individual and collective health and emotional and social functioning (Pfefferbaum, 2020). In many countries around the world, individuals are required to reduce physical contact to others outside one's household (social distancing) (Anderson et al., 2020). As an important segment of society, students' lives are being affected severely by the pandemic by additional measures such as lockdowns, quarantines, and closing of schools, and universities. Mental health problems among students due to the pandemic-related measures can affect their quality of life, academic achievement, physical health, and satisfaction with the college experience, and negatively impacting relationships with friends and family members. These issues can also have

long-term consequences for students, affecting their future employment, earning potential, and overall health (Eisenberg et al., 2007). Many students experience a lack of regular and compassionate communication from their institutions as a primary stressor during Covid-19, according to a nationwide survey (American Council on Education (ACE), 2020). Not only do students report uncertainty about academic options and what those options mean for their future, but more than half say that they do not know where to turn for mental health support. This lack of clarity is concerning since one in five students report that COVID-19 has significantly worsened their mental health (ACE, 2020).

It is known that the prevalence of epidemics accentuates or creates new stressors including fear and worry for oneself or loved ones, constraints on physical movement and social activities due to quarantine, and sudden and radical lifestyle changes. A recent review of virus outbreaks and pandemics documented stressors such as infection fears, frustration, boredom, inadequate supplies, inadequate information, financial loss, and stigma (Brooks, et al., 2020). Much of the current literature on psychological impacts of Covid-19 has emerged from the earliest hot spots in China. Although several studies have assessed mental health issues during epidemics, most have focused on health workers, patients, children, and the general population (Lai et al., 2020; Xie eta l., 2020). However, Yang et al. (2021) presented a recent study on the effects of three Covid-19 related stressors on perceived stress and mental health (i.e., physiological and psychological) of college students in China College students were more anxious and depressed during the initial outbreak of COVID-19 than they were during similar time frames in previous academic years, according to a Dartmouth study (2020).

A growing number of cross-sectional studies raise concerns about the effect of the pandemic on college student mental health (Fruehwirth et al., 2021), and some speak to potential factors that are related to our Covid-19 related stressors. One study found that depression and anxiety rates for undergraduates in 9 US public research universities in May/July 2020 were higher for those who had trouble adapting to distanced learning (Chirikov et al., 2020). Another conducted at a public university in the US in April 2020 found that worse mental health was associated with employment losses, difficulties focusing on academic work and concern about Covid-19 (Kecojevic et al., 2020). Two studies of college students in China using post-pandemic data found that family income stability was negatively associated with anxiety symptoms and that Covid-19 diagnosis of family or friends was positively associated with anxiety and depression symptoms (Cao et al., 2020).

A survey study by Wathelet et al. (2020), of 69,054 students in France who experienced quarantine due to Covid-19 pandemic found high prevalence rates of severe self-reported mental health symptoms. Among risk factors identified, female or nonbinary gender, problems with income or housing, history of psychiatric follow-up, symptoms compatible with Covid-19, social isolation, and low quality of information received were associated with altered mental health.

Sundarasen et al. (2020) examines its impact on the anxiety level of university students in Malaysia during the peak of the crisis and the pertinent characteristics affecting their anxiety. A cross-sectional online survey, using Zung's self-rating anxiety questionnaire was conducted during the Covid-19 pandemic and lockdown. Out of the 983 respondents, 20.4%, 6.6%, and 2.8% experienced minimal to moderate, marked to severe, and most extreme levels of anxiety.

Table 1 displays the results of a survey conducted by Center for Collegiate Mental Health (CCMH), Penn State University in the US, about widespread concerns of the students seeking services in the time of Covid-19 pandemic. The findings from the survey confirmed that 33% indicated that their reasons for seeking services were related to the COVID-19 pandemic or related events, while 67% did not. When asked to report which areas of their life had been negatively impacted by COVID-19, the students' response was that the most common areas affected were mental health (65%), motivation or focus (61%), loneliness or isolation (60%), academics (59%), and missed experiences or opportunities (54%).

Table 1: The areas mostly affected by Covid-19 Pandemic

Area of Impact	Percent
Mental health	65%
Motivation or focus	61%
Loneliness or isolation	60%
Academics	59%
Missed experiences or opportunities	54%
Career/employment	39%
Relationships (significant other, family, friends)	39%
Financial	32%
Health concerns (other)	27%
Health concerns (self)	24%
Grief/loss of someone	8%
Food or housing insecurity	8%
Discrimination/harassment	2%
Other (please specify)	1%

However, previous researches tended to agree with the above findings. With many universities having suspended classroom teaching and switched to online teaching, the lives of students have changed drastically. While social distancing measures may successfully slow down the spread of the infection and relieve the public health systems (Glass et al., 2006), they may eventually increase the social isolation of students and affect their psychological well-being and mental health (Bavel et al., 2020). Being under a lot of pressure to perform academically, students are prone to developing mental health problems (Mikolajczyk et al., 2008). The social networks of students have been argued to be an important factor in buffering stress and helping them to be more effective (Stadtfeld et al., 2019). Reduced social interactions, a lack of social support, and newly arising stressors associated with the COVID-19 crisis could potentially affect students' mental health negatively.

In this study, three important stressors among college students — academic workload, separation from school, and fear of contagion, as advocated by Yang et al. (2021) are considered. The research model put forward by Yang et al. (2021) and the goodness-of-fit of the model using Confirmatory Factor Analysis (CFA) are reviewed. The results of the CFA will be compared with the results obtained using a different mode of analysis, i.e., Partial Least Squares Structural Equation Modelling (PLS-SEM).

Objectives of Study

This study aims to revisit the work of Yang et al. (2021) regarding the effects of three stressors, i.e., academic workload, separation from school, and fears of contagious on students' perceived

URL: http://dx.doi.org/10.14738/abr.1011.13510

stress, which subsequently affect the mental health (physiological and psychological) of the college students. More specifically, this study relooks at the research framework (see Figure 1) proposed by Yang et al. (2021) from a different perspective particularly in the way the research framework is evaluated.

In this study, the well-known predictive analytics approach, the Partial Least Squares Structural Equation Modelling, was adopted to analyse the data collected by Yang et al. (2021). In contrast to the PLS-SEM method which is variance-based, Yang et al. (2021) adopted the Confirmatory Factor Analysis (CFA) which is a covariance-based method. In this paper the results of the PLS-SEM and CFA approaches were compared and the practical implication that could arise from both methods.

LITERATURE REVIEW

Stress is emotional feelings that make the person feel uncomfortable and unhappy with the situation that he or she has to overcome (Ganesh et al., 2012). Academic related stressors refer to any academic activity such as examination, co-curriculum, lifestyle, merit system (Saat et al., 2011), workload, time management (Wahat et al., 2012) and others. The term workload can be defined as the amount of work that being assigned to a person in a specified time period. In this case, assignment, tutorial, classes, test or examination, quizzes, report and practical are under academic workloads where student, especially university's student need to fulfilled in order to graduate (Yusoff et al., 2010a).

Previous study by Kausar (2010) among university students in Pakistan showed that there was positive relationship between academic workload and perceived stress among students.

Weerasinghe et al. (2012) proved that heavy academic workload is the most prominent factor affecting to stress level of undergraduates in Sri Lankan public universities in Colombo region where it dominating 90% of the top 10 stressor.

This study examined the relationships between Chinese college students' three critical stressors and two types of health in the Covid-19 pandemic context. The focus is on college students who had to endure the influence of several important stressors on their health during the Covid-19 pandemic. Yang et al. (2021) considered three important stressors among college students—academic workload, separation from school, and fear of contagion.

As pointed out by Dr. T. A. Ghebreyesus, the Director-General, World Health Organization (2020) that the impact of the pandemic on people's mental health is already extremely concerning. Social isolation, fear of contagion, and loss of family members is compounded by the distress caused by loss of income and often employment."

A study from India, during the COVID-19 pandemic, yields similar results (Saurabh and Ranjan, 2020) and further studies conducted in China find that young people report increased depressive symptoms and anxiety symptoms (Xie et al., 2019) and can experience negative psychological consequences as a result of the COVID-19 pandemic (Liang et al., 2020).

People respond to a world crisis such as Covid-19 pandemic in different ways. One of the most significant public health measures implemented during the COVID-19 pandemic has been

extended periods of 'lockdown', and closures of schools and university campuses (Millar et al., 2020). Lockdowns or quarantines are necessary as protective measures for physical health (Centers for Disease Control and Prevention (CDC), 2020), but prolonged impositions can be detrimental. It is a hostile experience that can cause severe financial stress (Reger et al., 2020; Thunström et al., 2020) due to loss of employment; social disorders such as social withdrawal, cyberbullying, alcohol misuse, and addiction; and mental health issues such as suicide attempts and depression [Gardner et al., 2015; Brooks et al., 2020).

The outbreak of COVID-19 has dominated news coverage and created widespread anxiety, even in people living miles away and not directly affected. Fears of contagion reflect feelings of apprehension about having or contracting COVID-19 (Yang et al., 2021). Being at a very early stage, the virus understandably has triggered fear and panic (Heshmat, 2020). Risk perception is rarely rational. Instead, people assess risks using a mixture of cognitive skills (weighing the evidence) and emotional appraisals (intuition or imagination) (Heshmat, 2020). Cognitive evaluations of risk are sensitive to probabilities and outcomes. In contrast, emotional reactions are sensitive to the vividness of visual imagery, and a variety of other factors that play a minimal role in cognitive evaluations. As a result of these differences, people often experience a discrepancy between emotional reaction to, and logical evaluations, of a threat (Loewenstein, et al., 2001).

Research Framework

Based on the arguments presented earlier and a comprehensive review of previous studies, a conceptual framework displayed in Figure 1 was proposed to model the relationships between the stressors, i.e., academic workload, separation from school and fear of contagion, the perceived stress, and the outcome, i.e., the mental health consisting of physiological and psychological health.

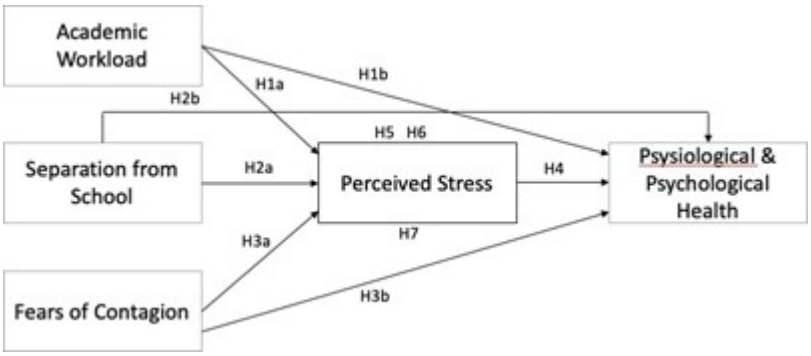

Figure 1: The Research Framework

In this framework, the stressors are considered as a set of independent or exogenous latent variables that cause the perceived stress of the students. Correspondingly, the mental health is considered as the dependent or endogenous latent variable that measures the effect of the perceived stress of the students. Meanwhile, the perceived stress can be considered as a mediating factor that mediates three direct relationships, i.e., the relationship between academic load and the mental health, between separation from school and the mental health, and between fear of contagious and the mental health, respectively:

H1a: Academic workload is positively correlated with perceived stress.

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H1b: Academic workload is negatively correlated with physical and mental health. H2a: Separation from school is positively correlated with perceived stress.
H2b: Separation from school is negatively correlated with physical and mental health. H3a: Fears of contagion are positively correlated with perceived stress.
H3b: Fears of contagion are negatively correlated with physical and mental health. H4: Perceived stress is negatively correlated with physical and mental health.
With the existence of the mediating factor, i.e., the perceived stress, the following hypotheses are to be tested;
H5: Perceived stress mediates significantly in the relationship between academic workload and physical and mental health.
H6: Perceived stress mediates significantly in the relationship between separation from school and physical and mental health.
H7: Perceived stress mediates significantly in the relationship between fears of contagion and physical and mental health.

METHODOLOGY

In this study, we consider the data collected by Yang et al. (2021) to further analyse the relationships in the research framework using PLS-SEM method in Figure 1. In their data collection procedure Yang et al. (2021) gathered from all variables that were assessed by participants' through self-administered anonymous online surveys. Data were collected took into account the need to minimize common method bias and the participants were asked to evaluate their academic workload, separation from school, fears of contagion, and necessary demographic information.

Empirical Analysis

Partial Least Squares Structural Equation Modeling (PLS-SEM) (Rigdon, Sarstedt, & Ringle, 2014) was adopted to analyse the conceptual framework. The model has two parts, i.e., measurement and structural models, and has direct as well as indirect relationships, which have been hypothesized earlier. For certain data conditions such as small sample size and non-normal data, PLS-SEM was found to be the most appropriate method (Hair Jr, Hult, Ringle, & Sarstedt, 2016). The key criteria for the goodness of fit are the size, sign, and significance of path coefficients, the R2 values, and the effect size f2 (Ali et al., 2018). The procedure developed by Nitzl et al. (2016) was used to test the mediation effects of Perceived Stress in the framework.

The empirical results of measurement and structural model assessments using the PLS-SEM based on the data collected by Yang et al. (2021) is illustrated in Figures 2a-2b. The improvements in the empirical results (e.g., the path coefficients and their significances) when using the PLS-SEM method as compared to the CFA used by Yang et al. (2021) can be observed Section 2.5.1 - 2.5.2.

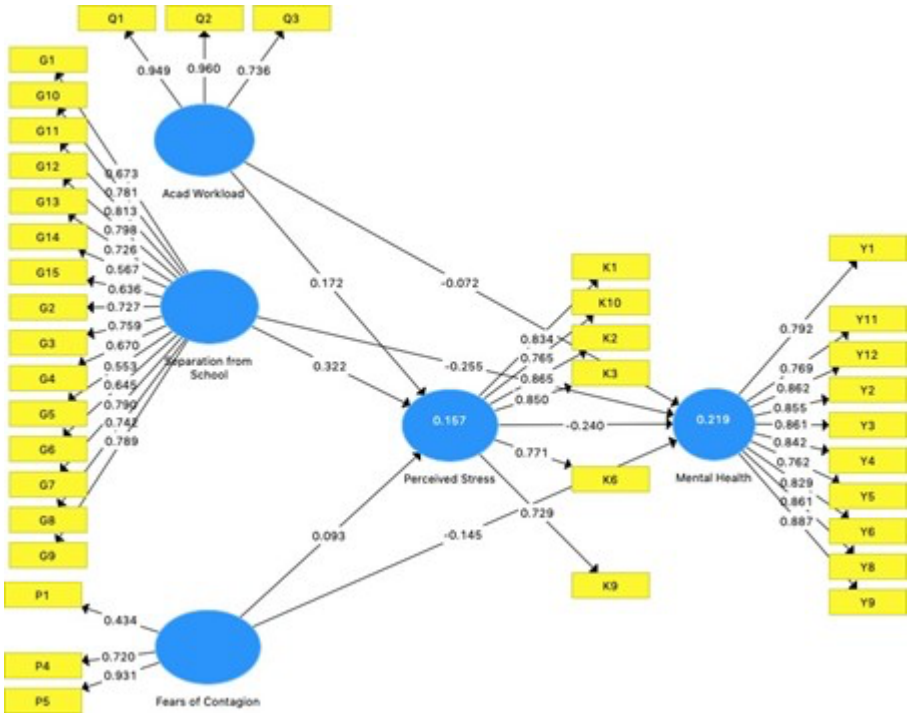

Figure 2a: The Measurement and Structural Model Assessment using PLS-SEM

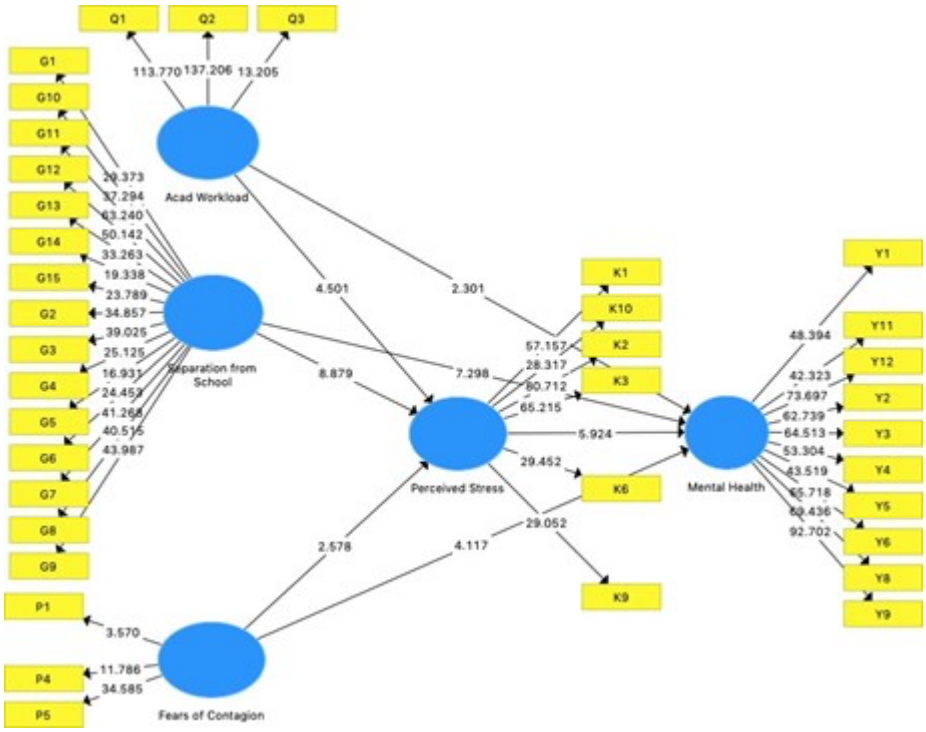

Figure 2b: The Bootstrapped Measurement and Structural Model Assessments

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It should be noted that for the refinement (i.e., improved goodness of fit) of the model, several items or indicators were removed from the corresponding constructs. The item or indicator B2 'In public, I don't mind sitting in a chair that has just been sat on' and the item B3 'In an elevator, I don't mind pushing a button without protection' associated with the stressor 'Fear of Contagion', were removed. Similarly, the items K4 'In the last month, how often have you felt confident about your ability to handle your personal problems?', K5 'In the last month, how often have you felt that things were going your way?', K7 'In the last month, how often have you been able to control irritations in your life?' and K8 'In the last month, how often have you felt that you were on top of things?' associated with the construct 'Perceived Stress' were omitted, while the item Y7 'been getting along well with your family or friends?' was removed from the construct 'Mental Health'. This implies that for the stressors 'Fear of Contagion', 'Perceived Stress', and 'Mental Health', the corresponding items eliminated are considered less relevant (or too much variations in the responses of the respondents) and do not contribute much to the betterment of the research model.

Assessment of the Measurement Model

The research model (Figure 1) was analyzed using SmartPLS 3.0, a PLS-SEM software. The measurement model in PLS is assessed in terms of item loadings and reliability coefficients (composite reliability), as well as the convergent and discriminant validity. Individual item loadings greater than 0.7 are considered adequate (Fornell & Larcker, 1981). The average variance extracted (AVE) measures the variance captured by the indicators relative to measure error, and it should be greater than 0.50 to justify using a construct (Barclay, Higgins, & Thompson, 1995). Table 2 shows the result of reflective measurement model that present the values of indicators loadings, composite reliability, Cronbach's alpha, and AVE.

Table 2: Measurement Model Assessment: Reliability and Discriminant Validity of the Constructs

Construct and Items	Loadings	CA	CR	AVE	Discriminant Validity
Academic Workload		0.882	0.916	0.787	Yes
Q1	0.949				
Q2	0.960				
Q3	0.734				
Separation from School		0.930	0.940	0.512	Yes
G1	0.672				
G2	0.727				
G3	0.759				
G4	0.671				
G5	0.553				
G6	0.645				
G7	0.790				
G8	0.742				
G9	0.790				
G10	0.782				
G11	0.813				
G12	0.798				
G13	0.728				
G14	0.567				
G15	0.635				
Fear of Contagion		0.600	0.751	0.522	Yes
P1	0.430				
P4	0.715				
P5	0.933				
Perceived Stressed		0.890	0.916	0.646	Yes
K1	0.834				
K2	0.865				
K3	0.850				
K6	0.771				
K9	0.730				
K10	0.766				
Mental Health		0.951	0.958	0.694	Yes
Y1	0.792				
Y2	0.855				
Y3	0.861				
Y4	0.842				
Y5	0.762				
Y6	0.829				
Y8	0.861				
Y9	0.887				
Y11	0.769				
Y12	0.862				

As shown in Table 2, CA values of all constructs are between 0.927 and 0.952 which are all above 0.7 as recommended by Hair et al., (2013). While CR values are between 0.945 and 0.963 which are higher than 0.7 and indicating adequate internal consistency (Gefen, Straub, & Boudreau, 2000). Thus, the measurements are considered acceptable and reliable.

Discriminant validity assessment has to turn out to be an accepted requirement for evaluating relationships between the latent variables (LVs). Using SEM-PLS, traditionally, there are two measures of discriminant validity are commonly used, i.e. cross-loadings and Fornell-Lacker criterion. Cross-loadings are attained by relating each LV's component scores with all the other items (Chin, 1998). If each indicator's loading is higher for its allocated construct than for any

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of the other constructs, and each of the constructs put in highest with its assigned items, it can be concluded that the dissimilar constructs' indicators are not substitutable. In the instance of PLS- SEM, each indicator loading on associated constructs should be greater than all of its cross-loadings as illustrated in Table 3 (Chin, 1998). Therefore, discriminant validity was met.

Table 3: Cross-loadings

	Academic Workload	Fears of Contagion	Mental Health	Perceived Stress	Separation from School
Q1	**0.949**	0.218	-0.143	0.203	0.037
Q2	**0.960**	0.244	-0.195	0.201	0.038
Q3	**0.736**	0.128	0.018	0.086	-0.069
G1	0.079	0.000	-0.226	0.246	**0.673**
G2	0.012	0.030	-0.217	0.243	**0.727**
G3	0.005	0.051	-0.263	0.238	**0.759**
G4	0.004	0.096	-0.299	0.201	**0.670**
G5	0.051	-0.017	-0.148	0.154	**0.553**
G6	0.049	0.112	-0.219	0.242	**0.645**
G7	-0.033	0.007	-0.252	0.236	**0.790**
G8	0.081	0.110	-0.277	0.274	**0.742**
G9	0.001	0.050	-0.272	0.242	**0.789**
G10	-0.055	0.049	-0.273	0.217	**0.781**
G11	0.001	0.028	-0.281	0.277	**0.813**
G12	-0.054	0.036	-0.330	0.211	**0.798**
G13	0.007	0.023	-0.238	0.266	**0.726**
G14	0.132	0.072	-0.169	0.251	**0.567**
G15	0.076	0.047	-0.202	0.262	**0.636**
P1	0.240	**0.434**	-0.053	-0.031	-0.095
P4	0.064	**0.720**	-0.121	0.090	0.035
P5	0.267	**0.931**	-0.224	0.165	0.080
K1	0.159	0.138	-0.350	**0.834**	0.265
K2	0.198	0.145	-0.340	**0.865**	0.303
K3	0.184	0.124	-0.308	**0.850**	0.269
K6	0.169	0.098	-0.239	**0.771**	0.253
K9	0.092	0.103	-0.234	**0.729**	0.230
K10	0.167	0.134	-0.252	**0.765**	0.280
Y1	-0.118	-0.132	**0.792**	-0.292	-0.261
Y2	-0.113	-0.161	**0.855**	-0.253	-0.254
Y3	-0.120	-0.196	**0.861**	-0.266	-0.231
Y4	-0.087	-0.174	**0.842**	-0.228	-0.263
Y5	-0.131	-0.162	**0.762**	-0.311	-0.257
Y6	-0.196	-0.207	**0.829**	-0.380	-0.305
Y8	-0.159	-0.202	**0.861**	-0.339	-0.334
Y9	-0.124	-0.210	**0.887**	-0.336	-0.340
Y11	-0.181	-0.155	**0.769**	-0.300	-0.303
Y12	-0.102	-0.185	**0.862**	-0.265	-0.305

Table 4: Fornell-Lacker Criterion for Discriminant Validity

	Academic Workload	Separation from School	Fears of Contagion	Perceived Stress	Mental Health
Academic Workload	**0.888**				
Separation from School	0.030	**0.716**			
Fears of Contagion	0.237	0.067	**0.724**		
Perceived Stress	0.204	0.333	0.155	**0.804**	
Mental Health	-0.163	-0.347	-0.216	-0.362	**0.833**

Table 5: Heterotrait-Monotrait Ratio (HTMT)

	Academic Workload	Separation from School	Fears of Contagion	Perceived Stress	Mental Health
Academic Workload					
Separation from School	0.088				
Fears of Contagion	0.328	0.134			
Perceived Stress	0.202	0.365	0.176		
Mental Health	0.153	0.361	0.234	0.383	

Furthermore, it is recommended that the Heterotrait-Monotrait ratio (HTMT) of the correlations approach to assess discriminant validity, which is the correlations of indicators across LV assessing different phenomena about the correlations of indicators within the same LV (Henseler, Ringle, & Sarstedt, 2015). According to Henseler et al. (2015), the exact HTMT threshold level is debatable. If the HTMT value is below 0.90, discriminant validity has been established between two constructs, whereas if the value of the HTMT is higher than this threshold. There is a lack of discriminant validity. The threshold value of 0.85 is used in this study as illustrated in Table 5. The findings show that all the values are less than 0.85, which imply discriminant validity. In conclusion, all the discriminant validity criteria, namely Fornell–Larcker criterion, the cross loadings, and HTMT, provide substantial evidence for the constructs' discriminant validity.

Assessment of the Structural Model

To assess the structural model, R2, beta, t-values via a bootstrapping procedure with a resample of 500, and the effect sizes (f2) as suggested by Hair et al. (2014) were performed.

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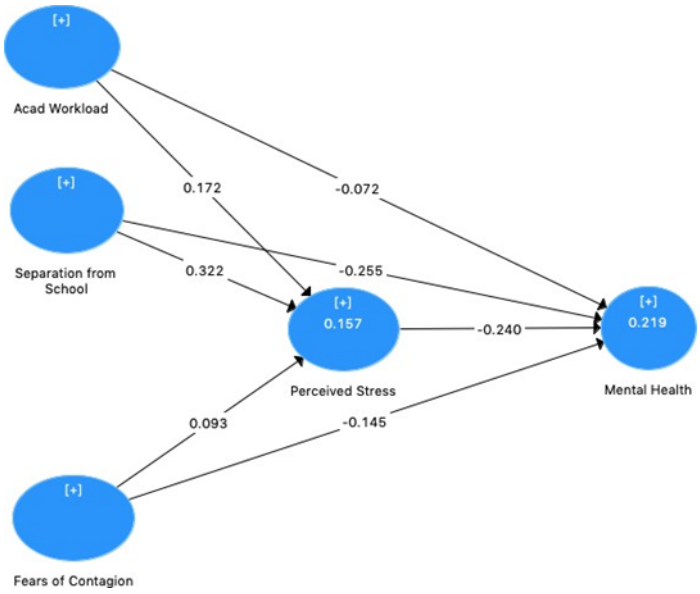

Figure 3a: The Structural Model

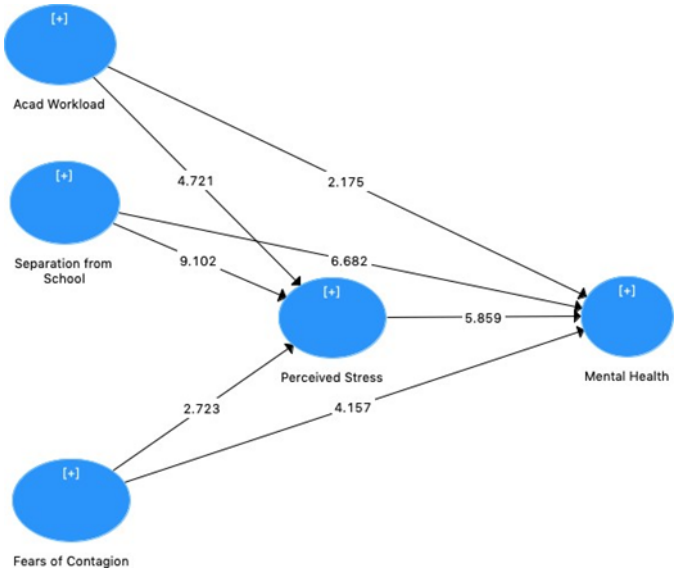

Figure 3b: The Bootstrapped Structural Model

For direct relationships in the research framework, Table 6 gives the estimated path coefficients, bootstrapped t-values, and p-values for the corresponding relationships. The relationship between Academic Workload and Perceived Stress (H1a) $\beta = 0.172$ ($p < 0.000$), Academic Workload and Mental Health (H1b) $\beta = -0.072$ (p-value = 0.022 < 0.05), Separation from school and Perceived Stress (H2a) $\beta = 0.322$ (p-value < 0.01). All the hypotheses H1a, H1b, and H2a were all supported. The relationship between Separation from school and Mental Health (H2b) $\beta = -0.255$ (p-value < 0.000) had a highly significant negative relationship. There exists a significant relationship between Fears of contagion and Perceived Stress (H3a) $\beta = 0.093$ (p-value = 0.010 < 0.05). Meanwhile, the significant relationship between Fears of

contagion and Mental Health (H3b) β = -0.145 (p-value< 0.000) was also supported. Finally, there exists a highly significant negative relationship between Perceived Stress and Mental Health (H4), β = -0.240 (p-value < 0.000).

Table 6: The Structural Model Path Coefficients

	Coefficient	Bootstrapped T-value	p-Value
Academic Workload -> Mental Health	-0.072	2.715	0.022
Academic Workload -> Perceived Stress	0.172	4.721	< 0.000
Separation from School -> Mental Health	-0.255	6.682	< 0.000
Separation from School -> Perceived Stress	0.322	9.102	< 0.000
Fears of Contagion -> Mental Health	-0.145	4.157	< 0.000
Fears of Contagion -> Perceived Stress	0.093	2.723	0.010
Perceived Stress -> Mental Health	-0.240	5.869	< 0.000

In this study, the role of Perceived Stress as a mediating factor was analysed. How this mediating factor affects the three stressors, nalely, Academic Workload, Separation from School, Fears of Contagion and Perceived Stress in enhancing Mental Health are also important to be examined. Table 7 illustrates the significance of indirect effect of the mediating variable (perceived stress) in the various relationships in the research model. The results indicate that the perceived stress was a significant mediating factor in all the relationships in the research model. While the perceived stress's indirect effect was highly significant (at 0.01 significance level) in both relationships between 'Academic workload and Mental Health' and 'Separation from School and Mental Health', its indirect effect was also significant (at 0.05 significance level) in the relationship between 'Fears of Contagion and Mental Health'.

Table 7: Indirect Effects

Indirect Relationships	Specific Indirect Effects	t-Statistic	p-values
Academic Workload -> Perceived Stress -> Mental Health	-0.041	3.297	0.001
Separation from School -> Perceived Stress -> Mental Health	-0.077	5.013	< 0.000
Fears of Contagion -> Perceived Stress -> Mental Health	-0.022	2.330	0.020

The R2 value for Perceived Stress was 0.157 and for Mental Health was 0.219, which are below the 0.26 value as suggested by Cohen (1988). Hair et al. (2014) have suggested an extra step by examining the change in the R2 value through the value of f2. The step involves omission of a specific exogenous or independent construct from the model and see the change in R2. It can be used to evaluate whether the omitted construct has a substantive impact on the endogenous construct. Table 8 show the results of R2 and adjusted R2, respectively.

URL: http://dx.doi.org/10.14738/abr.1011.13510

Table 8: R^2 and Adjusted R^2

	R^2	R^2 Adjusted
Academic Workload		
Separation from School		
Fears of Contagion		
Perceived Stress	0.157	0.154
Mental Health	0.219	0.215

Table 9 gives the results of effect size f2, i.e., the predictive capability of Academic Workload, Separation from School, Fears of Contagion and Perceived Stress in influencing Mental Health. Following the Cohen (1988) guideline, the effect sizes associated with the three stressors and the perceived stress in predicting mental health were lower than 0.02, representing the low predictive power of these factors on the mental health.

Table 9: Effect Size (f2)

	Acad Workload	Separation from School	Fears of Contagion	Perceived Stress	Mental Health
Academic Workload				0.033	0.006
Separation from School				0.122	0.074
Fears of Contagion				0.010	0.025
Perceived Stress					0.062
Mental Health					

Comparison with the results based on Confirmatory Factor Analysis (CFA) (Yang et al., 2021)

Yang et al. (2021) conducted an empirical analysis based on the same data set that they collected among Chinese college students for their study on the effects of three critical stressors and two types of health in the COVID-19 pandemic context. The estimated framework using CFA and the one using PLS-SEM in this study are illustrated in Figures 4a – 4b, respectively.

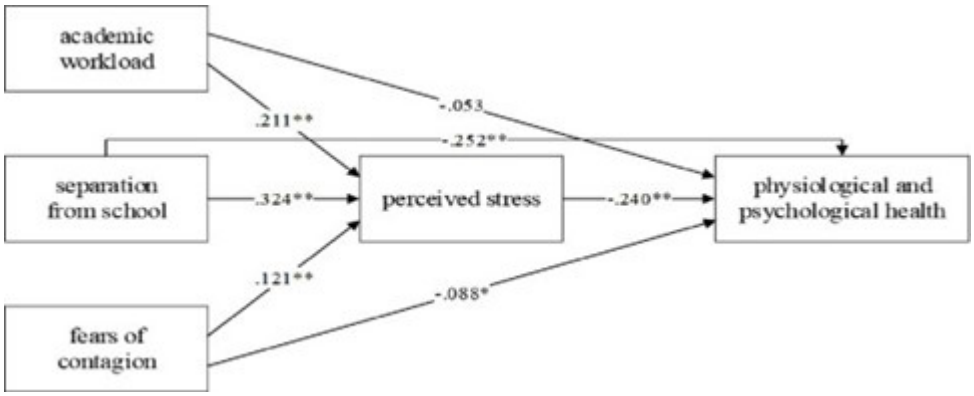

Figure 4a: The estimated Model using CFA (Yang et al., 2021)

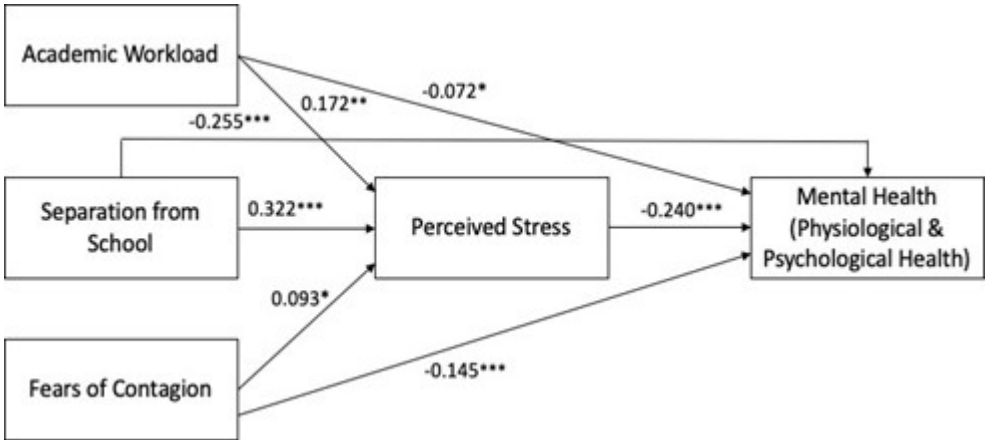

Figure 4b: The estimated Model using PLS-SEM from this study

The findings from Yang et al. (2021) concluded that all the relationships (in Figure 4a) are significant, except the relationship between 'Academic Workload' and 'Mental Health' (β = -0.053, not significant at 0.05 significance level). On the contrary, the PLS-SEM method suggested in this study showed that Academic Workload had a significant influence (β = -0.072, p-value = 0.02, at 0.05 significance level) on Mental Health of the students. This is in addition to the other significant results for the other hypotheses related to the various correlations or relationships in the research framework. The significant correlation between the Academic Workload' and 'Mental Health' in the analysis PLS-SEM method was the outcome of the refinement process involving the removal of a 'contradicting' item in the questionnaires developed by Yang et al. (2021), i.e., Y7 'been getting along well with your family or friends?'. This item (i.e., having positive connotation) seems to be contradicting with the rest of the items (i.e., negative connotation or undesired situations) in the questionnaires regarding 'Mental Health'.

CONCLUSIONS

The current COVID-19 crisis has imposed numerous restrictions on college students' well-being. The findings from the adoption of the PLS-SEM method for assessing the goodness-of-fit of the research model showed that the stressors (Academic workload, Separation from school, Fear of Contagion), the mediating factor (perceived stress), and the outcome (Mental health) in

URL: http://dx.doi.org/10.14738/abr.1011.13510

relation to the Covid-19 pandemic were all significantly correlated. This contributed to the improvement over the results obtained by Yang et al. (2021) when the CFA was adopted to assess the significances of the inter-relationships among the latent variables.

In reality, the stressors related to the pandemic are multi-facets and not confined only to the ones discussed in this study. Further research should explore a wider set of stressors that may contribute to perceived stress and eventually the mental health of the students. On the methodological aspect, this study may further explore the scenarios of the impacts of the stressors on the mental health of the students across demographic profiles such as gender, age groups, socio-economic background of the students, etc. Another aspect of analysis that could be of interest during the Covid-19 pandemic is in the impacts of social networks, friendship, interaction, social support, and studying with others. These factors have been argued to impact students' well-being and academic success, but they often require meeting opportunities and informal settings to develop (Stadtfeld et al., 2019; Boda et al., 2020).

References

Ali, F., Rasoolimanesh, S.M. and Cobanoglu, C. (2018a), Applying Partial Least Squares in Tourism and Hospitality Research, Emerald, Bingley.

Anderson, R. M., Heesterbeek, H., Klinkenberg, D., and Hollingsworth, T. D. (2020). How will country-based mitigation measures influence the course of the COVID-19 epidemic? Lancet, 2020.

American Council on Education (2020). Mental Health, Strategies for Leaders to Support Campus Well-Being American Council on Education AND COVID-19 HIGHER EDUCATION, https://www.acenet.edu/Documents/Mental-Health-Higher-Education-Covid-19.pdf

Bavel, J.J.V., Baicker K, Boggio PS, Capraro V, Cichocka A, Cikara M, et al. Using social and behavioural science to support COVID-19 pandemic response. Nature Human Behaviour. 2020;4(5):460–471.

Boda, Z., E. T., Vörös A., Stadtfeld C. (2020). Short-term and long-term effects of a social network intervention on friendships among university students. Scientific Reports. 2020;10(1):1– 12.

Brooks, S. K., Webster, R. K., Smith, L. E., Woodland, L., Wessely, S., and Greenberg, N. (2020). The psychological impact of quarantine and how to reduce it: rapid review of the evidence. Lancet 2020 Mar 14;395(10227):912-920.

Bruffaerts, R., Mortier, P., Kiekens, G., Auerbach, R. P., Cuijpers, P., Demyttenaere, K. (2018). Mental health problems in college freshmen: prevalence and academic functioning. J Affect Disord; 225:97-103.

Cao, W., Fang, Z., Hou, G., Han, M., Xu, X., and Dong, J. (2020). The psychological impact of the COVID-19 epidemic on college students in China. Psychiatry Res 2020 May;287:112934, doi: 10.1016/j.psychres.2020.112934.

Centers for Disease Control and Prevention (CDC) (2020). Available online: https://www.cdc.gov/coronavirus/2019-ncov/community/colleges-universities/ considerations.html

Chin, W.W. (1998), "The partial least squares approach to structural equation modeling", in Marcoulides, G.A. (Ed.), Modern Methods for Business Research, Mahwah, Erlbaum, pp. 295- 358.

Chirikov, I., Soria, K. M., Horgos, B., and Jones-White, D. (2020). Undergraduate and Graduate Students' Mental Health During the Covid-19 Pandemic, https://escholarship.org/uc/item/80k5d5hw#main

Cohen, J. (1988), Statistical Power Analysis for the Behavioral Sciences: Lawrence Erlbaum Associates.

Dartmouth College (2020). Covid-19 increased anxiety, depression for already stressed college students: Study shows unprecedented increase in mental health challenges among undergraduates." ScienceDaily. ScienceDaily, 27 July 2020. www.sciencedaily.com/releases/2020/07/200727114731.htm.

Eisenberg, D., Gollust, S. E., Golberstein, E., & Hefner, J. L. (2007). Prevalence and correlates of depression, anxiety, and suicidality among university students. American Journal of Orthopsychiatry, 77(4), 534–542.

Fruehwirth, J. C., Biswas, S. and Perreira, K.M. (2021). The Covid-19 Pandemic and Mental Health of First-Year College Students: Examining the Effect of Covid-19 Stressors Using Longitudinal Data, PLoS ONE, vol. 16, no. 3, Mar. 2021, pp. 1–15, doi:10.1371/journal.pone.0247999.

Ganesh, G., U. Kavitha, B. Anandarajan and M. Chandrasekar, 2012. A study to analyze various factors contributing to stress in first year MBBS students during examination. Int. J. Biomed. Adv. Res., 3: 700-703.

Gardner, P.J.; Moallef, P. (2015). Psychological impact on SARS survivors: Critical review of the English language literature. Can. Psychol. 2015, 56, 123.

Gefen, D., Straub, D., & Boudreau, M. C. (2000). Structural Equation Modeling Technique and regression: Guidelines for Research Practices. Communications for AIS, 7, 1-78.

Glass, R. J., Glass, L. M., Beyeler, W. E., and Min, H. J. (2006). Targeted social distancing design for pandemic influenza. Emerging Infectious Diseases, 12(11), 1671–1681.

Hair, J.F., Sarstedt, M., Hopkins, L. and Kuppelwieser, V.G. (2014), "Partial least squares structural equation modeling (PLS-SEM): an emerging tool in business research", European Business Review, Vol. 26 No. 2, pp. 106-121.

Hair Jr., J. F., Hult, G. T. M., Ringle, C., & Sarstedt, M. (2016). A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM). Thousand Oaks, CA: Sage Publications. https://doi.org/10.15358/9783800653614

Henseler, J., Ringle, C.M. and Sarstedt, M. (2015) A New Criterion for Assessing Discriminant Validity in Variance-Based Structural Equation Modeling. Journal of the Academy of Marketing Science, 43, 115-135, https://doi.org/10.1007/s11747-014-0403-8.

Heshmat, S. (2020). Why the Fear of Contagion Makes People Irrational: The roots of public fear perception. Psychology Today, https://www.psychologytoday.com/us/blog/science- choice/202002/why-the-fear-contagion-makes-people-irrational

Kausar, R., 2010. Perceived stress, academic workloads and use of coping strategies by university students. J. Behav. Sci., 20: 31-45.

Kecojevic, A., Basch, C. H., Sullivan, N. K., and Davi, N.K. (2020). The impact of the Covid-19 epidemic on mental health of undergraduate students in New Jersey, cross-sectional study. PLOS ONE. 2020 Sep 30; 15(9):e0239696. doi: 10.1371/journal.pone.0239696, 32997683

Lai, J., Ma, S., Wang, Y, Cai, Z., Hu, J., and Wei, N. (2020). Factors associated with mental health outcomes among health care workers exposed to coronavirus disease 2019. JAMA Netw Open 2020 Mar 02; 3(3): e203976, doi: 10.1001/jamanetworkopen.2020.3976.

Liang L, Ren H, Cao R, Hu Y, Qin Z, Li C, et al. The Effect of COVID-19 on Youth Mental Health. Psychiatr Q. 2020;(1163).

Loewenstein, G. F., Weber, E. U., Hsee, C. K., & Welch, E. S. (2001). Risk as feelings. Psychological Bulletin, 127(2), 267– 286.Millar et al., 2020

Mikolajczyk, R. T., Maxwell, A. E., El Ansari, W., Naydenova, V., Stock, C., Ilieva, S. (2008). Prevalence of depressive symptoms in university students from Germany, Denmark, Poland and Bulgaria. Social Psychiatry and Psychiatric Epidemiology, 43(2), 105–112.

Nelson, B., Pettitt, A., Flannery, J., Allen, N. (2020). Rapid assessment of psychological and epidemiological correlates of COVID-19 concern, financial strain, and health-related behavior change in a large online sample. Int J Methods in Psychiatr Res 2020 Apr 13;21(3):169-184. doi: 10.31234/osf.io/jftze.

Nitzl, C. (2016), "The use of partial least squares structural equation modelling (PLS-SEM) in management accounting research: Directions for future theory development", Journal of Accounting Literature, Vol. 37 No. December, pp. 19-35.

Penn State University Annual Report 2009. (2020). Center for Collegiate Mental Health. University Park, PA:. URL: https:/ /ccmh.memberclicks.net/assets/docs/2019-CCMH-Annual- Report_3.17.20.pdf.

Pfefferbaum, B. (2020). Mental Health and the Covid-19 Pandemic, The New England Journal of Medicine, April 13, 2020, https://www.nejm.org/doi/full/10.1056/NEJMp2008017.

Rigdon, Sarstedt, & Ringle, 2014. On Comparing Results from CB-SEM and PLS-SEM: Five Perspectives and Five Recommendations, Journal of Research and Management, 39(3), 4-16.

Reger, M.A.; Stanley, I.H.; Joiner, T.E. (2020). Suicide mortality and coronavirus disease 2019—A perfect storm? JAMA Psychiatry 2020.

Saat, N.Z.M., I. Ishak, S.H. Lubis and A.R. Ghazali, 2011. The effect of merit score towards the stress score among first year student. Proc.-Social Behav. Sci., 18: 613-616.

Saurabh K, Ranjan S. (2020). Compliance and Psychological Impact of Quarantine in Children and Adolescents due to Covid-19 Pandemic. Indian J Pediatr. 2020;87(July):532–6.

Son, C., Hegde, S., Wang, X., and Sasangohar, F. (2020). Effects of COVID-19 on College Students Mental Health in the US: Interview-survey Study, Journal of Medical Internet Research 22(9), e21279, http://dx.doi.org/10.2196/21279.

Thunström, L.; Newbold, S.C.; Finnoff, D.; Ashworth, M.; Shogren, J.F. (2020). The benefits and costs of using social distancing to flatten the curve for COVID-19. J. Benefit Cost Anal. 2020, 1–27.

Unger, K. (2007). Handbook on Supported Education: Providing Services for Students With Psychiatric Disabilities. Charleston, SC: BookSurge Publishing.

Wang, C. and Zhao, H. (2020). The impact of COVID-19 on anxiety in Chinese university students. Front Psychol, 11:1168, doi: 10.3389/fpsyg.2020.01168.

Weerasinghe, T. D., C. K. Batagod, Chandrika, K. A. C. and Siriwardans, W. K. C. U. (2012). Prevalence and determinants of stress among undergraduates: A study of public universities in Colombo region. Proceedings of the 7th International Research Conference on Management and Finance, December 14, 2012, University of Colombo, Sri Lanka, pp: 478-492.

Wahat, N.H.A., N.Z.M. Saat, C.K. Ching, L.Y. Qin and G.C. May et al., 2012. Time management skill and stress level among audiology and speech sciences students of Universiti Kebangsaan Malaysia. Proc.-Social Behav. Sci., 59: 704-708.

Wathelet, M., Duhem, S., Vaiva, G., Baubet, T., Habran, E., Veerapa, E., Debein, C., Molenda, S., Horn, M., Grandgenevre, P., Notredame, C.E, and D'Hondt, F. (2020). Factors Associated With Mental Health Disorders Among University Students in France Confined During the COVID-19 Pandemic ,JAMA Netw Open 2020 Oct 1 ;3(10):e2025591. doi: 10.1001/jamanetworkopen.2020.25591.

Xie, X., Xue, Q., Zhou, Y., Zhu, K., Liu, Q., and Zhang, J. (2020). Mental health status among children in home confinement during the coronavirus disease 2019 outbreak in Hubei Province, China. JAMA Pediatr, e201619, doi: 10.1001/jamapediatrics.2020.1619.

Yusoff, M.S.B., A.F.A. Rahim and M.J. Yaacob, 2010. Prevalence and sources of stress among universiti sains malaysia medical students. Malays. J. Med. Sci., 17: 30-37.