

ORIGINAL ARTICLE

Determinants of Academic Performance Among Undergraduates During COVID-19 in a Public University: A Cross-sectional Study

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ABSTRACT

Introduction: This study aims to examine the determinants of academic performance among students in Faculty of Medicine and Health Sciences (FMHS) in Universiti Putra Malaysia (UPM) during COVID 19 pandemic. **Method:** A cross sectional study was conducted between 1st March 2021 until 15th March 2021 to determine the factors associated with academic performance during COVID 19 pandemic among medical students in a public university. The questionnaires of COVID-19 Fear Scale, Student Stress Inventory-Academic Subscale, and self-reported academic performances were used. **Results:** The study revealed that lower stress level (OR 0.938, 95% CI 0.893-0.984), being non-medical students (OR 3.210, 95% CI 1.844, 5.587) compared with medical students, Chinese ethnicity (OR 2.932, 95% CI 1.635, 5.258) compared with non-Chinese ethnicity and a conducive study environment (OR 1.954, 95% CI 1.168, 3.268) compared with non-conducive study environment were the determinants of good academic performance among undergraduates in a public university during COVID 19 pandemic. **Conclusion:** These findings indicate that low stress level, non-medical course, Chinese ethnicity, and good study environment are significant factors associated with good academic performance during COVID-19 pandemic among undergraduate students in a public university. Therefore, institutions may benefit from taking these factors into account when developing interventions to enhance students' academic outcomes.

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INTRODUCTION

SARS-CoV-2, the virus responsible for the disastrous outbreak of COVID-19 in Wuhan, China in December 2019, had led the WHO to declare a pandemic on March 11, 2020 (1). In Malaysia, the virus resulted in over 571,901 cases and 2,796 deaths in just over 14 months: from March 16, 2020, to May 21, 2021(2). Covid vaccines were then still in progress, hence the pertinent solution at that time was to reduce in-person contact. This had resulted in the closure of non-essential services, including schools and universities (3). To overcome this, education departments had to adapt to

new forms of teaching and learning amid lockdowns and social distancing measures. During the peak of the pandemic, the teaching and learning activities were exclusively conducted online, with no in-person classes. These online classes were made possible with the emergence of the many online platforms such as Zoom, Google Meet, and Google Classroom (4).

However, online learning comes with its own set of challenges (4). The poor internet connectivity and technical issues in the rural area did not provide a friendly online learning environment (4). Furthermore, Jaafar et al found that students in the rural areas of Sabah and Perlis, Malaysia demonstrated low digital literacy compared to students from the more urban and internet discerning areas of Klang Valley (4). These challenges have affected the academic performance of students and led to major mental and physical health problem such

as depression, anxiety, stress, and sleep deprivation (4). Academic performance is the knowledge, skills and abilities acquired in the field and is evaluated based on the grades, and academic achievements (5). The factors affecting the academic performance of students during COVID-19 pandemic were age (6), gender (6), ethnicity (7), economic status (8), conduciveness (9), internet accessibility (4), satisfaction of online class (10), fear towards COVID-19 (11) and stress (12). Overall, the determinants for academic performance may differ depending on students' academic level. Nevertheless, it is essential to note that this online learning was a response to an unprecedented condition rather than well-scheduled online courses.

Amidst the pandemic, fear becomes a significant factor contributing to psychological distress due to a sense of uncertainty and ambiguity within the educational setting. The weight of these anxieties cannot be underestimated, as they directly impact students' learning activities and academic achievements (11). Moreover, a compelling study conducted among undergraduate students had reported that those who reported stress have poorer academic performance compared to those who reported minimal stress impact (12). There have not been many studies carried out about it in Malaysia, especially for medical students. This study aims to examine the determinants of academic performance among students of Faculty of Medicine and Health Sciences (FMHS) in Universiti Putra Malaysia (UPM) during COVID 19 pandemic.

MATERIALS AND METHODS

Study design and study location

This was a cross sectional study among undergraduates in the FMHS, Universiti Putra Malaysia. The data collection was conducted from 1st March 2021 until 15th March 2021 to determine the factors associated with academic performance during the COVID-19 pandemic among public university undergraduate students in Serdang, Malaysia. Participants were from various fields and disciplines, specifically those pursuing degrees in Doctor of Medicine, Bachelor of Biomedical Sciences with Honours, Bachelor of Nursing, Bachelor of Science Dietetic with Honours, Bachelor of Science Environmental and Occupational Health with Honours, and Bachelor of Science Nutrition and Community Health with Honours. These programmes duration were four years, except for the medical programme, which was five years long.

Study population and sample size estimation

Undergraduate students aged 18 years or older who were then registered active students at FMHS UPM were included into this study. Using Epi Info 7.0, sample size was calculated based on the prevalence of academic performance among nursing students, which varied from 24.1 to 49.5 percent [13]. With 90 percent power,

95 percent confidence interval (CI), and a statistically significant level (α) at 5 percent, the estimated sample size was 270. After considering for a non-response rate of 35 percent (13) due to online study, the final sample size required was 415 respondents (13).

Study instrument

The questionnaire was divided into four sections: sociodemographic factors, COVID-19 Fear Scale, Student Stress Inventory-Academic Subscale, and Self-reported Academic Performances. The COVID-19 Fear Scale comprised of seven questions with 5-point Likert scale response assessed the level of fear towards the pandemic among the participants (14). The Malay version of the questionnaire had undergone a vigorous validation process by Pang et al and is a valid and reliable tool to be used (14). The score of the Fear towards COVID-19 questionnaire ranges from 7 to 35. A higher score suggests greater levels of fear in relation to COVID-19. The Academic Subscale of the Student Stress Inventory that comprised of ten items with a 4-point Likert-type scale response was designed to assess academic stress situations. The score of the Student Stress Inventory ranges from 10 to 40. Higher score indicates higher levels of stress (15). This scale has been validated locally by Mohammad Aziz Shah and reported to be a valid and reliable instrument for utilization. (15). Finally, the self-reported academic performances were the scores that the participants obtained in their recent examination. This was intended to assess their comprehension and feasibility of them to answer each item of the questionnaire. As a measure of reliability, a pilot test was conducted with a 10% subset of the sample size, excluding the main study subjects. Face validity was conducted among ten medical students to test the clarity of the questionnaire and they agreed that the questions measure what they are intended to measure. The reliability of the tools was assessed in the pilot study using Cronbach's alpha value. The Cronbach's alpha value was 0.861 for the COVID-19 Fear Scale and 0.798 for the Student Stress Inventory-Academic Subscale.

Data collection

There were 770 students in FMHS. The participants (year one to five students) were randomly selected for the study using an online randomizer. The distribution of English and Malay questionnaires took place via the WhatsApp application using Google Forms between the 1st and 15th of March 2021. The investigator sent weekly notifications a maximum of two times to the participants. Those who did not provide complete responses or failed to do so within the specified time frame were excluded from the study.

Operational definition

Participants' self-reported academic performance was given range options for them to choose either <50, 50-60, 60-70, 70-80 or >80 (16). Good academic performance was defined as the score ≥ 80 and poor

academic performance was defined as the mark <80(16). The socioeconomic status of the respondents was determined based on their family household income, with those earning RM 3,860 and below classified as the bottom 40% (B40), those earning between RM 3,860 and RM 8,319 classified as the middle 40% (M40), and those earning more than RM 8,319 classified as the top 20% (T20) (17). Their study environment was asked in a likert scale: either very uncondusive, uncondusive, neutral, condusive, or very condusive. Subsequently, these responses were categorized into two groups: condusive (neutral, condusive, and very condusive) and not condusive (uncondusive and very uncondusive).

Ethical consideration

Ethics approval was obtained from the Medical Research and Ethic Committee for Research Involving Human Subject Universiti Putra Malaysia (JKEUPM-2021-109) to ensure ethical compliance.

Data analysis

The data was analysed using the IBM Statistical Package for Social Science (SPSS) version 26. Mann-Whitney U test and Chi Square test were used to compare the association between academic performance and sociodemographic factors, education programme, household income, conduciveness of the environment, internet accessibility, satisfaction towards online classes, fear of COVID-19 level and stress levels of the undergraduates. Regression tests were used to determine the determinants of academic performance of participants. A simple logistic regression analysis (SLR) was performed to identify potential independent factors that have a p-value less than 0.25 for the subsequent multiple logistic regression analysis (MLR). The MLR was then conducted, using a significance level of $p < 0.05$. The results of the MLR are presented as odds ratios (OR) along with a 95% confidence interval (CI).

RESULTS

Response Rate

Out of the 770 students in our sample population, we received responses from 412 participants, resulting in a response rate of 82.4%. Initially, we distributed the Google Form to a randomly selected group of 415 students, but we fell short of reaching our intended sample size of 415 from this initial group. It was only after expanding the distribution to a total of 500 students that we successfully obtained our target sample size of 415 respondents.

Sociodemographic and clinical profiles of the respondent during COVID-19 pandemic

Table I presents the sociodemographic characteristics of the 412 participants in the study. The median age of the participants was 21 years old, with an interquartile range of 2 years. Female accounted for most of the participants (72.6%), while the largest ethnic group

TABLE I: Sociodemographic and clinical profiles of the respondent during COVID-19 pandemic (N=412)

Variables	n (%)	Median (IQR)
Age		21 (2)
Gender, Female	299 (72.6)	
Male	113 (27.4)	
Ethnicity, Malay	265 (64.3)	
Chinese	79 (19.2)	
Indian	54 (13.1)	
Others	14 (3.4)	
Course, Medic	158 (38.3)	
Non-medic	252 (61.7)	
Year of study, Year 1	91 (22.1)	
Year 2	147 (35.7)	
Year 3	64 (15.5)	
Year 4	85 (20.6)	
Year 5	25 (6.1)	
Family household income, B40	153 (37.1)	
M40	179 (43.4)	
T20	80 (19.4)	
Internet accessibility, Wi-Fi	294 (71.4)	
Data plan	118 (28.6)	
Study environment, very uncondusive	9 (2.2%)	
Uncondusive	36 (8.7%)	
Neutral	124 (30.1%)	
Condusive	175 (42.5%)	
Very condusive	68 (16.5%)	
Satisfaction towards online classes, not satisfy	77 (18.7%)	
Neutral	169 (41.0%)	
Satisfied	166 (40.2%)	
Fear COVID-19 score		18 (7)
The student stress score		27(8)
Latest examination test score, <50	16 (3.9)	
50-60	49 (11.9)	
60-70	104 (25.2)	
70-80	145 (35.2)	
>80	98 (23.8)	

among the participants was Malay (64.3%) and came from M40 socioeconomic group. The highest percentage of participants were 2nd year students, studying Doctor of Medicine (38.3%), followed by Bachelor of Science Nutrition and Community Health with Honours (15.8%). With regards to study environment, majority of the participants reported having a condusive study environment (42.5%) and were satisfied with their online class (40.2%). Most students (71.4%) used a data plan to access the internet, while the remaining used Wi-Fi.

Association between sociodemographic characteristics and clinical parameters among FMHS students and their academic performance during COVID-19 pandemic

A greater proportion of participants reported poor academic performance (76.2%) than those who reported excellent performance (23.8%). Table II presents the association between sociodemographic factors and academic performance. There were significant associations between academic performance and course of study ($p=0.001$), ethnicity ($p<0.001$), conduciveness of the environment ($p=0.033$), internet accessibility ($p=0.070$) and student stress level ($p=0.014$).

The multiple logistic regression model included the independent variables that had a p-value of less than 0.25 in the bivariate analysis. These independent

variables consisted of course of study ($p=0.001$), ethnicity ($p<0.001$), conduciveness of the environment ($p=0.033$), internet accessibility ($p=0.070$) and student stress level ($p=0.014$). Table III shows the predictors of a good academic performance among FMHS students using multiple logistic regression. Lower stress level, non-medical course students, Chinese compared with Malay students and learning in a conducive environment are significantly associated with better academic performance. Having stress level are (OR 0.938, 95% CI 0.893-0.984) less likely to achieve good academic performance. Non-medical based students are 3.2 times more likely to achieve good academic performance (OR 3.210, 95% CI 1.844, 5.587) compared to medical based students. Chinese participants are 2.9 times more likely to achieve good academic performance (OR 2.932, 95% CI 1.635, 5.258) compared to Malays. Students learning in a conducive study environment are 1.9 times more likely to achieve good academic performance (OR 1.954, 95% CI 1.168, 3.268).

Table II: Comparison association between sociodemographic data and clinical parameters among FMHS students with and without excellent academic performance during COVID-19 pandemic (n=412)

Variables	Academic performance		p-value	
	not excellent	Excellent		
	n (%), 314(76.2)	n (%), 98(23.7)		
Course of study*	Medic	135 (85.4)	23 (14.6)	0.001
	Non-medical	179 (70.5)	75 (29.5)	
Year of study*	Preclinical	229 (75.8)	73 (24.2)	0.761
	Clinical	85 (77.3)	25 (22.7)	
Gender*	Female	299 (79.9)	70 (29.9)	0.771
	Male	85 (75.2)	28 (24.8)	
Ethnicity*	Malay	217 (81.9)	48 (18.1)	<0.001
	Chinese	47 (59.5)	32 (40.5)	
	Indian	41 (75.9)	13 (24.1)	
	Others	9 (64.3)	5 (35.7)	
Household income*	B40	119 (77.8)	34 (22.2)	0.846
	M40	135 (75.4)	44 (24.6)	
	T20	60 (75.0)	20 (25.0)	
Internet accessibility*	Wi-fi	217 (73.8)	77 (26.2)	0.070
	Data plan	97 (82.2)	21 (17.8)	
Conduciveness of study environment*	No	139 (82.2)	30 (17.8)	0.033
	Yes	175 (72.0)	68 (28.0)	
Satisfaction towards online class*	No	194 (78.9)	52 (21.1)	0.325
	Yes	120 (72.3)	46 (27.7)	
Age ^	21(2)	21(3)	0.272	
COVID-19 fear score^	18 (6)	18 (6)	0.547	
Student stress score ^	28 (8)	26 (8)	0.014	

*:Chi square test was used ; ^: Mann-whitney U test was used, FMHS: Faculty of Medicine and Health Sciences

Table III: Determinants of good academic performance among FMHS students during COVID-19 pandemic (n=412)

Variables		AOR	95% CI		p-value
			Lower	Upper	
Student stress level		0.938	0.893	0.984	0.009
Course of study	Non-Medic	3.21	1.844	5.587	<0.001
	Medic	1			
Ethnicity					0.002
	Others	3.041	0.916	10.097	
	Indians	1.453	0.679	3.109	
	Chinese	2.932	1.635	5.258	
Study environment	Conduciveness	1.954	1.168	3.268	0.011
	Not Conduciveness	1			
Internet accessibility	Wifi	1.524	0.85	2.73	0.157
	Data plan				

FMHS: Faculty of Medicine and Health Sciences
 Backward logistic regression was used and the model reasonably fits well (Hosmer Lemeshow test: $\chi^2=11.608$; $P=0.170$); model assumptions were met; no significant interactions and multicollinearity problem; model explained between 10.4% (Cox and Snell R²) and 15.6% (Nagelkerke R²) of the variance for inappropriate medication dosage. The model correctly classified 77.2% of cases *Statistical significance at $P < 0.05$; AOR—adjusted odds ratio; CI—confidence interval.

DISCUSSION

This study, which was conducted after about 1 year of mainly online learning, suggested several factors that are significantly associated with academic performance during COVID-19 pandemic. Firstly, the study found a significant negative association between stress level and academic performance during COVID-19 pandemic, where students who reported lower levels of stress had better academic performance during COVID-19 pandemic. This finding is consistent with prior research that has highlighted the negative impact of stress on academic performance particularly in the context of the COVID-19 pandemic (12, 18-19). The global health crisis has brought about unprecedented challenges and disruptions in the education system, leading to increased stress levels among students. The uncertainties surrounding the pandemic, changes in learning environments, and the need to adapt to remote or hybrid learning have contributed to heightened stress levels among students. Elevated stress levels can furthermore impede cognitive functioning, memory, concentration, and information processing (12, 18-19), making it more difficult for students to effectively engage in their studies. Consequently, students' ability to focus, retain information, and perform well in exams were affected.

Secondly, non-medical students were associated with higher probability of achieving excellent academic performance during COVID-19 pandemic. The possible explanation was the teaching in non-medical courses

may exert more theoretical aspect and less dealings with human in comparison to the medical course learning where clinical and practical exposures are integral. Hence with the pandemic learning cycles of the medical students are affected badly (20). The comparatively less academic workload in the non-medical courses resulted in potentially fewer responsibilities, lower stress level and decrease external pressure. This allows for greater ability to focus during lecture and subsequently nurture the excellence academic performance that are seen among these non-medical students. (21).

Thirdly, Chinese ethnicity was found to be associated with a higher likelihood of achieving good academic performance during COVID-19 pandemic. Our study was consistent with previous studies (22, 23); Manan AA and Shamsudin S in 2012 explored the academic performance of students from different ethnicities (Malay vs Chinese) in Malaysia prior to COVID-19 pandemic (22). Another study by Alfian E and Othman N showed similar findings among undergraduate students' performance at the University of Malaya in 2005 (23). The emphasis on education and academic achievement in Chinese culture, have been suggested as potential explanations for the association between Chinese ethnicity and good academic performance (24, 25). Nevertheless, it is important to consider other factors that might contribute to these findings. For instance, socioeconomic status and academic preparation could also play a role in shaping academic performance among students of Chinese ethnicity in the local context (24, 25).

Furthermore, the significant association between a favorable study environment and good academic performance during the COVID-19 pandemic is in line with several other studies conducted in different contexts (26-28). Realyv6squez-Vargas A et al (2020) who explored the impact of environmental factors on the academic performance of university students taking online classes during the COVID-19 pandemic in Mexico reported that their academic performances are significantly influenced by environmental temperature, lighting, and noise (26). Similarly, Keržič D et al (2021) conducted research on academic student satisfaction and perceived performance in the e-learning environment during the COVID-19 pandemic across ten countries (27). Their study provides insights into the relationship between the learning environment in the e-learning setting and student satisfaction and perceived performance. The readiness for online learning is heavily reliant not only on the structure and system support of e-learning but also on the proficiency and delivery skills of the staff involved (28,29). Indeed, providing quality online teaching services results in a positive impact on students' academic experiences and outcomes during the COVID-19 environment (30). All these studies support the idea that a quality online teaching resulting from positive and conducive learning

environment plays a vital role in promoting students' academic success during the COVID-19 pandemic. Institutions can benefit from recognizing the importance of the learning environment and investing in strategies to create an environment that supports students' academic performance, whether in online or traditional settings.

Strength and limitations

Nonetheless, the study utilized a multiple logistic regression analysis, which allowed for the examination of multiple confounding factors related to academic performance during COVID-19 pandemic simultaneously.

The study included a diverse sample of students, which enhances the generalizability of the findings to other student populations. However, there were some limitations such as the study was conducted in a single institution, which may limit the generalizability of the findings to other institutions or settings. The study relied on self-report measures for some of the predictor variables, such as stress level and study environment, which may be subject to response biases and may not accurately reflect the true levels of these variables.

The study was cross-sectional in design, which limits the ability to establish causality between the predictor variables and academic performance. Future research may benefit from using longitudinal designs to examine the causal relationships between these variables. The study did not consider other potentially important factors that may influence academic performance, such as motivation, or academic ability. Therefore, future research may need to take these factors into account to better understand their impact on academic performance.

In summary, the findings of this study provide valuable insights into the predictors of academic performance among undergraduate students during the COVID-19 pandemic. Nonetheless, it is important to recognize the limitations of the study and consider these when interpreting the results. Further research is needed to build upon these findings and provide a more comprehensive understanding of the factors that influence academic performance among undergraduate students.

CONCLUSION

Our study found that lower level of stress, non-medical course, Chinese ethnicity, and conducive study environment were significant associated with higher academic performance during COVID-19 pandemic. Understanding the factors that positively impact academic performance allows training providers to tailor interventions and support services to support the students' mental health, and online learning. By incorporating these practical implications into their strategies, training providers can create an environment

that fosters academic success, supports students' mental well-being, and equips them with the tools to navigate challenges during any infective pandemic and beyond. Further research will enhance insights for improving students' academic outcomes.

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