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SMARTPHONE USAGE AND PATTERNS TOWARDS SELF -REPORTED SYMPTOMS DURING EARLY 2019 CORONAVIRUS PANDEMIC LOCKDOWN AMONG MEDICAL STUDENTS IN MALAYSIA.

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ABSTRACT

Introduction: Smartphone ubiquity has become profound during coronavirus disease (COVID-19). Prior research suggests smartphone usage and patterns correlated with self-reported symptoms. This study aimed to evaluate smartphone usage and associated patterns of self-reported symptoms among medical students in Malaysia during COVID-19 pandemic lockdown. **Materials and Methods:** This was a cross-sectional study of 252 medical students who were given questionnaires regarding sociodemographic, socio-economic characteristics, smartphone usage and patterns of self-reported symptoms. Total severity scores of self-reported symptoms were calculated. Association between socio-demographic, socio-economic and academic performance status with smartphone usage and patterns were examined using simple and multiple linear regression analysis. **Results:** Mean Smartphone Addiction Scale–Malay score for smartphone usage was 101.43 (SD = 25.15). Smartphone patterns revealed 7 years of smartphone ownership, 32 minutes per day on calls and 4 hours per day on others (for entertainment (50%) and non-entertainment (50%) purposes. They had one extra device and used their smartphone 15 minutes after waking up in the morning. After controlling other factors, father's employment status (adjusted (Adj.) ß=7.431, 95% CI: 3.069, 11.793) and smartphone usage for entertainment purposes (Adj. ß = 4.211, 95% CI: 0.460, 7.962) were only two significant predictors for self-reported symptoms. **Conclusion:** Father's employment status and smartphone usage for entertainment purposes were associated with increase frequency of self-reported symptoms among medical students during the early lockdown of the COVID-19 pandemic in Malaysia. Parents' participation from early childhood and public campaigns to avoid smartphone addiction are essential.

Keywords: **COVID-19, Medical student(s), Pattern(s), Symptoms, Smartphone.**

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Keywords: **COVID-19, Medical student(s), Pattern(s), Symptoms, Smartphone.**

INTRODUCTION

There has been an upsurge in research into smartphone use among young people, but little on long-term monitoring of their potential health effects.[1] Non-ionising radiation penetration into their brains may consequently change the permeability of the blood–brain barrier, which, young individuals are believed to be more prone to symptoms of smartphone usage.[2] A powerful electromagnetic field (EMF) may induce illnesses such as insomnia, headaches, and allergy-like symptoms, known as

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Electrical Hypersensitivity (EHS), although no definite causal link between EMF exposure and symptoms has been shown.[3] In two studies conducted on junior high school and university students respectively, frequent smartphone usage has been reported to be associated with headaches, memory loss, insomnia, and other mental disorders.[4,5] Students' coping techniques and priorities, such as coursework, may go unrecognised masking the health symptoms.[2]

On March 18th 2020, Malaysian government imposed measures to limit viral transmission and decrease contact with affected patients of coronavirus disease 2019 (COVID-19).[6] The global pandemic has affected the operational activities of educational institutions, which require pupils to carry out online studies at home and may inadvertently increase their access and exposure to mobile technology. Hence self-reporting of symptoms such as headaches, insomnia, memory loss etc may be expected to increase during the lockdown period.

The aim of this study was to investigate the frequency and patterns of smartphone usage among medical students at Universiti Kebangsaan Malaysia (UKM) and the association of self-reported symptoms during the COVID-19 pandemic lockdown. We hypothesised a higher smartphone usage and an associated increase in self-reported symptoms during the period of COVID-19 pandemic lockdown.

MATERIALS AND METHODS

From 16th March to 14th April 2020, a cross-sectional study was performed among UKM undergraduate Medical Degree students with smartphones, utilising proportionate stratified random sampling, in the setting of COVID-19 lockdown.[6] The UKM Ethics Committee granted ethical approval (FF-2020-105). All participants gave written consent for participation and were divided into groups based on their clinical year and exposure: preclinical (first and second years) and clinical (third, fourth and fifth years), by randomly generated students' matriculation numbers. Medical students with psychiatric disorders, cancer, thyroid disease, anaemia, explicit drug use, pregnant or hospitalised for any reason were excluded.

Utilising Kish equation, the sample size derived was 252, with 10% for missing data or drop-out, based on self-reported physical symptoms value of 'Pain in the neck muscle, 58.5%, n = 134'.[7,8] This study's sample size was determined using 80% power and a 0.05 of type I error. Where precision was needed, the 95% CI and 5% precision were used.

Study tools

Utilising a web-based Google sheet form to record the responses, the first part included data on sociodemographic and socioeconomic factors, such as age, ethnic, parents' income, occupation, and educational levels, as well as the student's funding status and academic achievement. The second segment focused on smartphone usage patterns, including the amount of smartphone use on a regular day, the length of smartphone ownership, the time between wake up and smartphone initial use, the number of additional gadgets owned, and the most important smartphone function.

Smartphone usage details were requested in the third section. The Smartphone Addiction Scale–Malay (SAS-M) was utilised, which previously created, translated, and validated among Malaysian medical students, with Cronbach's alpha of 0.94.[9] The SAS-M features six subscales (cyberspace-oriented connection, everyday life disturbance, primacy, overuse, etc.) of 33 items. Cronbach's alpha was 0.91 among 30 participants, while the corresponding coefficients for the six vari-

ables were 0.78, 0.76, 0.86, 0.67, 0.83, and 0.85. Each item is scored on 1–6 scale (1 = strongly disagree; 6 = strongly agree), with scoring of 33–198, which higher values suggesting likely of smartphone addiction or use.[9]

The fourth segment dealt with self-reported symptoms. Each student declared the ten symptoms encountered and assessed their severity on a scale of 0–10, with 0 representing none and 10 representing often everyday. Using the Total Score of Severity (TSS) equation[11]:

- TSS per person = Σ (self-reported symptom × symptom's severity factor)

TSS is the sum of ten self-reported symptoms experienced. TSS ratings range from 0 to 100, with higher values indicating more severe symptoms.[10]

Statistical analysis

Continuous variables were summarised using mean and standard deviation (SD) and categorical variables were summarised using frequencies and percentages (%). Using SPSS version 25 (Statistical Package for Social Sciences), data on smartphone usage and patterns were analysed using Student's t-test, Pearson's chi square, and Pearson's correlation. Using simple and multivariate linear regression (MLR), we found the main component contributing to the association between smartphone usage and patterns with self-reported symptoms. The significance level for all tests was 0.05. All tests were two-sided, and $p<0.05$ was deemed significant.

RESULTS

The characteristics of the participants (Table I) reported that the mean age (SD) was 23.09 (1.84) years; 75.4% were females, and 59.9% were of Malay origin. The partici-

Table I: Participant's characteristics, smartphone usage and pattern.

Participant's Characteristics	n (%) N = 252	(Mean (SD)
Age (years)		23.09 (1.84)
Gender		
Male	62 (24.6)	
Female	190 (75.4)	
Ethnicity		
Malay	151 (59.9)	
Chinese	47 (18.7)	
Indian	42 (16.7)	
[a]Others	12 (4.8)	
Parents' income (RM)		6641.57 (7067.56)
Father's occupational status		
Employed	190 (75.4)	
Unemployed	62 (24.6)	
Mother's occupation status		
Employed	136 (54.0)	
Unemployed	116 (46.0)	
Father's education level		
Nil	2 (0.8)	
Primary	18 (7.1)	
Secondary	77 (30.6)	
Diploma / Certificate	54 (21.4)	
Tertiary	101 (40.1)	
Mother's education level		
Nil	4 (1.6)	
Primary	15 (6.0)	
Secondary	97 (38.5)	
Diploma / Certificate	53 (21.0)	
Tertiary	83 (32.9)	
Funding status		
Yes	49 (19.4)	
No	203 (80.6)	
Academic achievement (CGPA)		3.2 (0.37)
Smartphone usage and patterns		
Smartphone usage		
SAS-M score		101.43 (25.15)
Smartphone patterns		
Most personal smartphone feature		
Entertainment	126 (50.0)	
Non-entertainment	126 (50.0)	
Time spent making or receiving phone calls per day (minutes)		32.17 (49.97)
Non-call related smartphone usage per day (hours)		4.26 (4.29)
Ownership of smartphone (years)		7.23 (2.77)
Time from waking to first smartphone usage in the morning (minutes)		14.68 (34.92)
Number of additional devices owned		1.38 (0.68)

Abbreviations: SD standard deviation, RM Ringgit Malaysia
[a]Others, n (%): Bumiputera 3 (1.2), Kadazan 2 (0.8), Bajau 1 (0.4), Bidayuh 1 (0.4), Bugis 1 (0.4), Dusun 1 (0.4), Punjabi 1 (0.4), Siamese 1 (0.4), Sino-Kadazan 1 (0.4)

pants' parents earned an average (SD) of RM6641.57 (RM7067.56) a month in gross monthly earnings; 40.1% of the participants' fathers had achieved tertiary education, while 38.5% of the participants' mothers had completed secondary school. The majority of respondents had working parents: 75.4% of fathers and 54% of mothers. Approximately 80.6% of the participants were not obtaining any aid or loan for their present studies, and the previous semester's cumulative grade point average CGPA (SD) was 3.2 (0.37).

The participants' average period of smartphone ownership was 7 years with an average (SD) SAS-M score for smartphone usage (Table I) of 101.43 (25.15) and utilisation of smartphones were equally divided for entertainment and non-entertainment purposes (50%). They made or received calls on average for around 32 minutes per day, and that they spent approximately 4 hours per day on smartphone usage other than calls. They had one additional gadget in addition to their smartphone, and they used their smartphone within 15 minutes of waking up in the morning.

In terms of self-reporting of symptoms, majority of the medical students scored zero (range 24.6-81.3%) and did not report any symptoms. The three most common self-reported symptoms were insomnia (75.4%), neck pain (67.9%) and headache (63.9%), although in the majority, these were either mild or moderate in rating scale (Table II:). Less than a third complaint of moderate symptoms scale (4-6), of which majority were reporting of insomnia (Table II: 29.3%). Eleven percent or less of participants reported moderatedly high symptom score (7-8) and very few (range 0.4 to 4.4%) reported high symptom score (Scale 9-10). Overall, the average TSS (SD) for all reported symptoms was low at 17.84 (15.58) out of a 100 (Table II).

There was a significant association between being of Malay ethnicity, having employed and well-educated parents, participant's academic achievement with increased smartphone usage (Table III) and to various smartphone usage patterns (Table IV).

After adjusting for other variables, multivariable analysis revealed that father with employment status and using smartphone for entertainment function were the significant predictors of higher TSS (Table V). Medical students whose father

Table II: Self-reported symptoms among medical students.

Self – reported symptoms	Rating Scale n (%)					Mean (SD)
	0	1-3 (Mild)	4-6 (Moderate)	7-8 (Moderately high)	9-10 (High)	
Headache	91 (36.1)	106 (42.1)	42 (16.76)	12 (4.8)	1 (0.4)	
Dizziness	111 (44.0)	93 (36.9)	38 (15.1)	9 (3.6)	1 (0.4)	
Neck pain	81 (32.1)	94 (37.3)	49 (19.4)	22 (8.8)	6 (2.4)	
Hearing problem	161 (63.9)	54 (21.4)	30 (12.0)	5 (2.0)	2 (0.8)	
Vision problem	99 (39.3)	81 (32.1)	47 (18.6)	21 (8.4)	4 (1.6)	
Insomnia	62 (24.6)	77 (30.5)	74 (29.3)	28 (11.1)	11 (4.4)	
Palpitation	172 (68.3)	53 (21.0)	17 (6.8)	8 (3.2)	2 (0.8)	
General exhaustion	109 (43.3)	75 (29.7)	44 (17.5)	17 (6.8)	7 (2.8)	
Shortness of breath	205 (81.3)	40 (15.9)	5 (2.0)	0	2 (0.8)	
Temporary memory loss	156 (61.9)	65 (25.7)	24 (9.5)	4 (1.6)	3 (1.2)	
Total Score of Severity (TSS)						17.84 (15.58)

Abbreviations: SD standard deviation, SAS-M Smartphone Addiction Scale-Malay version, TSS Total Score of Severity

Table III: Smartphone usage across sample characteristics.

Variables	Smartphone usage Mean (SD)	(SAS-M score) t / r	p value
Sociodemography			
Age (years)		-0.015[a]	0.814
Gender			
Male	100.9 (20.86)	.213[b]	0.832
Female	101.6 (26.45)		
Ethnicity			
Malay	115.43 (16.56)	14.75[b]	***<0.001****
Non-Malay	80.50 (20.92)		
Socioeconomy			
Parents' income (RM)	-	-0.003[a]	0.960
Father's Occupational Status			
Employed	107.53 (22.53)	7.430[b]	***<0.001****
Unemployed	82.74 (23.63)		
Mother's Occupational Status			
Employed	119.82 (16.29)	20.601[b]	***<0.001****
Unemployed	79.87 (14.15)		
Father's education level			
High	106.48 (29.04)	4.81[b]	***<0.001****
Low	93.36 (13.93)		
Mother's education level			
High	105.48 (32.62)	3.001[b]	***0.003****
Low	96.68 (9.46)		
Funding status			
Yes	100.81 (25.74)	0.791[b]	0.430
No	103.98 (22.61)		
Academic achievement	-	0.987[a]	***<0.001****

[a]r = Pearson's correlation coefficient; [b]t = Student's t-test value
Abbreviations: SD standard deviation, RM Ringgit Malaysia
*p value = statistically significant at <0.05

were employed at the time of study were seven times more likely to self-report of symptoms, (Table V: adjusted ß = 7.431, 95% CI: 3.069, 11.793), and using their smartphone for entertainment function, was associated with a four times increase in self-reported symptoms (Table V: Adj. ß = 4.211, 95% CI: 0.460, 7.962).

DISCUSSION

The SAS-M score (SD) of 101.43 (25.15) indicated the participants' smartphone usage, similar with those of previous local research, which showed marks of >98[5] and 102.52.[4] The results of other international studies are consistent with ours since they used the same score in modified Spanish, Arabic, and Turkish, which higher score indicates a greater risk of smartphone use or addiction.[11, 12] During the COVID-19 pandemic, medical students are expected to rely heavily on technology for learning, since all Malaysian Higher Learning Institutions have transitioned to synchronous or asynchronous online learning.[13]

The average period of smartphone ownership in this survey, i.e. 7 years, is close to an Indian study that showed smartphone ownership among the majority of students was 1–8 years, since smartphones are now a necessity.[14] Our results that participants made or received calls for around 32 minutes per day and spent approximately 4 hours per day on usage other than calls are similar with

Table IV: Smartphone patterns across sample characteristics.

Variables	V1		V2		V3		V4		V5		$V6_1/V6_2$	
	Mean (SD)	t/r (p value)	Mean (SD)	t/r (p value)	Mean (SD)	t/r (p value)	Mean (SD)	t/r (p value)	Mean (SD)	t/r (p value)	Mean $(SD)_1$/Mean $(SD)_2$	t/r (p value)
Age (years)	-	-0.008[a] (0.903)	-	0.029[a] (0.649)	-	0.010[a] (0.872)	-	0.024[a] (0.703)	-	0.005[a] (0.932)	23.17(2.06) / 23.0(1.59)	0.685[b] (0.494)
Gender												
Male	28.34 (43.12)	0.694[b] (0.488)	3.81 (2.26)	0.951[b] (0.343)	7.76 (2.57)	1.747[b] (0.082)	12.34 (38.47)	0.607[b] (0.545)	1.40 (0.66)	0.348[b] (0.728)	-	2.139[c] (0.144)
Female	33.42 (52.05)		4.41 (4.77)		7.05 (2.82)		15.44 (33.75)		1.37 (0.69)			
Ethnicity												
Malay	39.3 (58.81)	3.163[b] ***(0.002)****	5.35 (2.81)	5.157[b] ***(<0.001)****	7.26 (2.75)	0.224[b] (0.823)	14.9 (36.19)	0.122[b] (0.903)	1.40 (0.67)	0.766[b] (0.444)	-	0.413[c] (0.520)
Non-Malay	21.5 (29.80)		2.64 (5.47)		7.18 (2.81)		14.35 (33.09)		1.34 (0.71)			
Parents' income (RM)	-	0.032[a] (0.617)	-	-0.009[a] (0.888)	-	-0.044[a] (0.492)	-	0.012[a] (0.849)	-	0.047[a] (0.454)	6601.98 (7843.97) / 6681.15 (6226.52)	0.089[b] (0.929)
Father's occupational status												
Employed	33.41 (55.10)	0.691[b] (0.490)	4.93 (4.68)	6.868[b] ***(<0.001)****	7.32 (2.79)	0.898[b] (0.370)	13.56 (32.61)	0.894[b] (0.372)	1.38 (0.70)	0.080[b] (0.937)	-	0.086[c] (0.770)
Unemployed	28.35 (29.12)		2.23 (1.56)		6.95 (2.73)		18.12 (41.29)		1.37 (0.63)			
Mother's occupational status												
Employed	36.75 (60.66)	1.652[b] (0.100)	6.20 (5.03)	9.597[b] ***(<0.001)****	7.27 (2.74)	0.284[b] (0.777)	14.19 (37.87)	0.239[b] (0.811)	1.37 (0.67)	0.234[b] (0.815)	-	0.000[c] (1.000)
Unemployed	26.79 (32.80)		1.99 (0.91)		7.17 (2.82)		15.25 (31.24)		1.39 (0.71)			
Father's education level												
High	33.86 (60.44)	0.798[b] (0.426)	5.14 (5.23)	5.259[b] ***(<0.001)****	7.26 (2.55)	0.277[b] (0.782)	14.62 (41.98)	0.034[b] (0.973)	1.26 (0.60)	3.196[b] ***(0.002)****	-	0.017[c] (0.897)
Low	29.46 (25.62)		2.86 (1.03)		7.16 (3.11)		14.77 (18.97)		1.56 (0.76)			
Mother's education level												
High	32.08 (59.92)	0.029[b] (0.977)	5.26 (5.62)	4.469[b] ***(<0.001)****	7.01 (2.71)	1.313[b] (0.190)	13.34 (38.40)	0.660[b] (0.510)	1.32 (0.580)	1.498[b] (0.136)	-	0.575[c] (0.448)
Low	32.27 (35.15)		3.09 (0.68)		7.47 (2.83)		16.25 (30.41)		1.45 (0.78)			
Funding status												
Yes	30.61 (50.94)	1.009[b] (0.314)	4.30 (4.62)	0.317[b] (0.752)	7.30 (2.81)	0.808[b] (0.420)	15.23 (38.11)	0.507[b] (0.613)	1.38 (0.68)	0.342[b] (0.732)	-	2.052[c] (0.152)
No	38.63 (45.65)		4.09 (2.52)		6.94 (2.61)		12.41 (16.04)		1.35 (0.72)			
Academic achievement	-	0.139[a] ***(0.027)****	-	0.728[a] ***(<0.001)****	-	0.052[a] (0.413)	-	-0.049[a] (0.440)	-	-0.078[a] (0.219)	3.190 (0.35) / 3.178 (0.39)	0.257[b] (0.797)

[a]r = Pearson's correlation coefficient; [b]t = Student's t-test value; [c]X^2 = Pearson's Chi-Square value; Abbreviations: SD standard deviation, RM Ringgit Malaysia
*p value = statistically significant at <0.05. **Note: V1: Time spent making or receiving phone calls on a normal day (minutes); V2: Typical day's smartphone usage (excluding calls) (hours); V3: Time spent using a smartphone (years); V4: Time to first smartphone usage in the morning (minutes); V5: Number of additional devices owned (devices); $V6_1$: Most personal smartphone feature (Entertainment); $V6_2$: Most personal smartphone feature (Non-entertainment).**

Table V: Factors associated with Total Score of Severity among medical students.

Variables	Mean (SD)	SLR[a]			MLR[b]		
		ß[c]	(95% CI)	p value	Adj. ß[d]	(95% CI)	p value
Sociodemography							
Age (years)	-	-0.89	(-1.95, 0.16)	0.10	-	-	-
Gender							
Male	16.58 (16.19)	-1.67	(6.17, 2.82)	0.46	-	-	-
Female	18.25 (15.40)						
Ethnicity							
Malay	19.41 (16.32)	3.92	(0.008,7.84)	0.05	-	-	-
Non-Malay	15.5 (14.17)						
Parents' income (RM)		7.83×10^{-5}	(-0.0002,0.0004)	0.56	-	-	-
Father's Occupational Status							
Employed	19.61 (16.49)	7.19	(2.78, 11.60)	***0.001****	7.43	(3.07,11.79)	***0.001****
Unemployed	12.42 (10.85)						
Mother's Occupational Status							
Employed	19.19 (16.57)	2.93	(-0.94, 6.80)	0.14	-	-	-
Unemployed	16.26 (14.25)						
Father's education level							
High	17.55 (15.17)	-0.74	(-4.73, 3.24)	0.71	-	-	-
Low	18.30 (16.29)						
Mother's education level							
High	19.01 (15.51)	2.53	(-1.34, 6.41)	0.20	-	-	-
Low	16.47 (15.63)						
Funding status							
Yes	17.71 (15.59)	-0.65	(-5.55, 4.24)	0.79	-	-	-
No	18.37 (15.72)						
Academic achievement	4.49	(0.77,9.76)	0.09	-	-	-	
Smartphone usage characteristics							
SAS-M score		0.06	(-0.02, 0.13)	0.14	-	-	-
Smartphone patterns characteristics							
Time spent making or receiving phone calls per day (minutes)		0.030	(-0.01, 0.07)	0.13	-	-	-
Non-call related smartphone usage per day (hours)		-0.08	(-0.53, 0.37)	0.73	-	-	-
Ownership of smartphone (years)		0.34	(-0.36, 1.04)	0.33	-	-	-
Time from waking to first smartphone usage in the morning (minutes)		0.02	(-0.03, 0.080)	0.39	-	-	-
Number of additional devices owned		-0.45	(-3.29, 2.39)	0.75	-	-	-
Most personal smartphone feature							
Entertainment	19.92 (16.96)	4.16	(0.32, 8.00)	***0.03****	4.21	(0.46, 7.96)	***0.03****
Non entertainment	15.76 (13.83)						

[a]Simple linear regression
[b]Multiple linear regression (R^2 = 0.044)
[c]Crude regression coefficient
[d]Adjusted regression coefficient
Notes: Multiple linear regression after controlling factors of sociodemography, socioeconomic status and academic achievement
*p value = statistically significant at <0.05

South Korean students, who used smartphones for 2–4 hours per day on average.[15] In contrast, given the age disparities, a study conducted in Pakistan reported 11–14 hours daily smartphone used among medical practitioners (mean age, 23 years). [16] Malaysians appear to be following local trends by spending more time on quick gratification applications like WhatsApp, Instagram, and Facebook.[17] This era has a culture in which smartphones are their companions for playing, chatting, shopping, and spending their free time that is vastly different from that of their parents. The participants in the current study utilised their smartphones evenly for entertainment (50%) and non-entertainment (50%), which contrasts with a study from India, where smartphones were mostly used for social communication.[18] We also discovered that participants used their smartphones 15 minutes after getting up in the morning, which differs from the majority of Swiss adolescents, who do so within 5 minutes. [19] In light of the devices' affordability and availability, the number of devices possessed was slightly increased, i.e. having an extra device, comparable to that reported in a local research.[17] According to the universal gratification theory (UGT), individuals resort to technology to fulfil their social and psychological needs makes it difficult to draw definite conclusions regarding smartphone use since cultures, values, and beliefs vary everywhere.[20]

The majority of medical students in our study scored zero for self-reported symptoms, indicating that they did not have any (range 24.6-81.3%), which contradicts with our hypothesis that frequent smartphone usage may be associated with higher frequency of self-reported symptoms. This is further supported by an overall low TSS score of 17.84. In our study, 63.9% self-reported symptom of headache which is slightly more than that reported in Iranian students (53.5%) but less than that of Iraqi students, 82.1% of whom experienced headache.[8,10] This is nevertheless an issue, given the number of students who reported symptoms of varying severity, including insomnia (75.4%), neck discomfort (67.9%), headache (63.9%), visual difficulties (60.7%), and overall fatigue (56.7%). The distribution of symptoms differed from that of Iraqi students; in particular, insomnia (58.5%), neck pain (73.8%), headache (64.6%), visual difficulties (82.1%), and overall tiredness (69.9%).[8] The National Radiological Protection Board addressed the concern in 2011 that a substantial proportion of frequency radiation may ultimately permeate the user's body parts and head, as well as up to two inches into the human brain.[21] Current International Commission on Non-Ionizing Radiation Protection recommendations have highlighted concerns in adults, where smartphone radiation has a detrimental impact on cognitive functioning, cell communication, and fertility.[21] In contrast, contrary findings show that smartphones pose no such hazards and are not strong enough to destroy atomic bonds or tissue.[3] Because modern smartphones are more user-friendly, safer, and ergonomic than older smartphones or mobile phones, the present study's mean TSS score is low.[3] The impact on human health is unknown since they are classed as category 2B by the International Agency for Research on Cancer (minimal evidence in humans but less than sufficient data in experimental animals).[22] With years of cancer and neurodegenerative disease delays, it may take some time for the negative consequences to become apparent; by then, it may be too late.[3]

Further bivariate analysis indicated that being Malay, having working and highly educated parents, also academic achievement are important factors linked with smartphone usage. The Malay ethnicity was crucial since it was the predominant ethnic group in Malaysia. The findings on working parents contradict a Korean research, which found that the parents of the most smartphone addicted

children were mostly unemployed and had just a high school education.[23] The explanation for this might be that the sample group included children rather than university students. On the other hand, our results of increased smartphone usage outcomes contrast with those of Iranian students, who reported worse academic success because pupils were mentally occupied, resulting in a lack of concentration and focus in the lessons.[24] A local study also found highly educated parents had significant association with smartphone usage and certain smartphone patterns (making or receiving calls, purpose other than calls, extra devices owned), indicating high socioeconomic status of parents' ability to support students' monthly smartphone payments.[20] Aside from the desire for amusement, an American study found that when students utilise electronic educational devices, such as smartphones, throughout class sessions, their success improves by maximising time on task completion and using the camera to turn abstract concepts into tangible thoughts.[25] According to another research, smartphones increase students' productivity and educational achievement[25] by allowing them to download online lectures, read e-books, and use applications such as clouds to produce, post, retrieve, and exchange learning material with their friends.

The severity of symptoms reported by the participants in the current research was predicted by two major predictors. Firstly, the participants' TSS was influenced by their father's employment position. Our findings contradict a South Korean study, probably due to age differences, in which the study represented parents' employment insecurity and less than a high school degree.[23] Those parents are most likely ignorant of their responsibility to monitor their children's smartphone use and provide poor care for the child in terms of detecting the symptoms that their children may acquire as a result of smartphone exposure. It has also been established that trends in children's smartphone use can result in psychological behavioural patterns[26]: prospects for social interactions and physical activity may decrease as a result of smartphone fascination, resulting in negative physical symptoms in the long run. These findings indicate that smartphone usage has a detrimental impact on children's educational environments and development, which is evident in symptom severity.

We discovered that the smartphone's entertainment feature is another factor that contributes to higher TSS scores, which is consistent with an Iranian study.[10] Participants in the current study indicated entertainment activities such as listening to music, playing games, watching movies, reading comic books, and maintaining social connection, particularly during the lockdown time. This is supported by Zuckerman's sensation-seeking theory of experience, which explains how people discover stimulus and resilience to dullness.[27] Prolonged smartphone use, on the other hand, may result in a variety of symptom severity due to: (a) poor ergonomics (headaches, neck, shoulder, and jaw pain) from anterior head syndrome[1] and (b) EMF or blue light exposure (insomnia, vision changes, difficulty concentrating, dry and irritated eyes).[28] The adoption of education and entertainment technologies, which cause excessive tension to the spine and digital eye strain, might have a severe impact on the younger generation who are still developing.[89]

Our findings have certain limitations in terms of generalisation. To begin with, doing the study in different contexts was unavoidable. The research was first done prior to the countrywide COVID-19 lockdown order being issued[6], and half of the results were received during the lockdown period, implying a lengthier screening time since each student relied significantly upon on e-learning system. We are unable to eliminate the possibility of reporting bias when using self-reported

data. Nonetheless, the study adds to our understanding of the impact of smartphone exposure on the severity of self-reported symptoms as perceived by participants, as well as previous evidence of smartphones influencing mental health.[4, 5, 11, 26, 29]

CONCLUSION

During the early period of COVID-19 lockdown in Malaysia, frequency of medical students' self-reported symptoms were independently associated with their father's employment status and use of smartphone for entertainment purposes only. Despite this, the overall effect of smartphone usage on self-reported symptoms in general is low with the majority of medical students reporting no symptoms.

In the absence of regulation that controls healthy smartphone usage, parental involvement and supervision must begin in early education. Supportive systems that offer counselling or avoidance treatment on various forms of entertainment should be created. Public awareness initiatives for appropriate smartphone use beginning in early infancy are critical for reducing smartphone reliance. Parental smartphone usage and patterns may have a moderating influence. More research is required to establish a causal connection between smartphone usage and patterns and its association with other health-related outcomes, to understand the long-term implications. There is no clear evidence of harmful health impacts, yet no research has proved smartphones are safe, etiher.

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CONTRIBUTION

Both authors contributed equally, have read and approved the final version of the manuscript and agreed to be accountable for all aspects of the work.

CONFLICT OF INTEREST

The authors declared no potential conflicts of interest with respect to research, authorship, and/or publication of this article.

AVAILABILITY OF DATA AND MATERIALS

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

CONFERENCE PRESENTATION

This study has been presented at the 22nd National Public Health Colloquium, Department of Community Health, Universiti Kebangsaan Malaysia on May 4th-6th 2021, online event.

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