UNIVERSITI PUTRA MALAYSIA

A CROSS-SECTIONAL STUDY ON THE RELATIONSHIP BETWEEN SMARTPHONE ADDICTION AND SOCIODEMOGRAPHIC FACTORS ON MIGRAINE AMONG MEDICAL STUDENTS IN UNIVERSITY PUTRA MALAYSIA

GROUP 13

ON SHI QING
NURUL SYAFIQAH BINTI BURAIRAH
VIMALRAJ A/L KANTHASAMY

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On, S.Q.[1], Nurul Syafiqah, B.[1], Vimalraj, K.[1], AP Wan Aliaa, W.S.[2], Hayati, K.[3]

[1]Second Year Medical students, Faculty of Medical and Health Sciences, University Putra Malaysia

[2]Department of Medicine, Faculty of Medical and Health Sciences, University Putra Malaysia

[3]Department of Community Health, Faculty of Medical and Health Sciences, University Putra Malaysia

ABSTRACT

Background: Migraine is a major disabling disease worldwide. It can affect the quality of life and academic performances of students. Smartphone addiction has also become a worrying situation among the young population as the advancement of models and functions of smartphones. This study aimed to determine the relationship between smartphone addiction and sociodemographic factors on migraine among medical students in University Putra Malaysia.

Materials and Methods: A cross sectional study was conducted from June 2020 until October 2020 in UPM, Serdang, Selangor. Through random sampling, 150 medical students were chosen from Year 1 to Year 5 medical students to participate in a self-administered, pretested questionnaire. Migraine was screened by ID-Migraine questionnaire and Smartphone addiction was screened by Smartphone Addiction Scale (SAS). Data was analysed using SPSS Version 25. All hypotheses tested were two sided and level of significance was set at 0.05.

Result: Out of 137 respondents, majority of them which were 88 (64.2%) were female, 40 (29.2%) were Year 1 medical students and 67 (48.9%) were from T20 family. 73(53.3%) medical students have smartphone addiction and 29(21.2%) experienced migraine. 11(37.9%) medical students categorized into Grade 1 disability of migraine. There was no significant association between smartphone addiction(p=0.137), gender (p=0.784), year of study (p=0.418), and family income(p=0.342) with migraine.

Conclusion: There was no relationship between smartphone addiction and sociodemographic factors on migraine among medical students.

Keywords: Migraine, Smartphone Addiction, Medical students, Prevalence

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APPROVAL SHEET

It is certified that we have read the project dissertation entitled A Cross-sectional Study on The relationship between Smartphone Addiction and Sociodemographic factors on Migraine among medical students in University Putra Malaysia (UPM), 2020 by On Shi Qing, Nurul Syafiqah binti Burairah and Vimalraj A/L Kanthasamy. In our opinion, the satisfaction in terms of scope, quality and presentations as a requirement for Package 11 are achieved.

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(Supervisor)

AP DR. WAN ALIAA WAN SULAIMAN

Department of Medicine,

Faculty of Medicine and Health Sciences, University Putra Malaysia.

.....

(Co-Supervisor)

AP DR. HAYATI KADIR@SHAHAR

Department of Community Health,

Faculty of Medicine and Health Sciences, University Putra Malaysia.

DECLARATION

We declared that this project is our original work except for the quotation and citation which have been duly acknowledged. We also declared that this project has not been previously and has not been concurrently submitted for any other degree at University Putra Malaysia or any other institutions.

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On Shi Qing

Date: 27th September 2020

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Nurul Syafiqah binti Burairah

Date: 27th September 2020

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Vimalraj A/L Kanthasamy

Date: 27th September 2020

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CHAPTER 1

INTRODUCTION

1.1 Background

Migraine is a major disabling disease worldwide. Migraine is a hereditary neurovascular headache disorder which is common, multifactorial, disabling and recurrent. An international study in developing Asian countries showed that migraine accounts for 66.6% (range: 50.9%–85.8%) of all headache services at neurological clinics (Wang et al. 2008). It usually strikes sufferers a few times per year in childhood and then progresses to a few times per week in adulthood, particularly in females. Attacks often begin with warning signs (prodromes) and aura (transient focal neurological symptoms) whose origin is thought to involve the hypothalamus, brainstem, and cortex. Once the headache develops, it typically throbs, intensifies with an increase in intracranial pressure, and presents itself in association with nausea, vomiting, and abnormal sensitivity to light, noise, and smell (Burstein, Noseda and Borsook, 2015). The prevalence for migraine has been investigated a lot for the past 50 years and described the burden of migraine on individuals and communities worldwide. Researchers have proposed that patients with migraine have a higher risk of mortality due to a high vulnerability to other fatal diseases. Although numerous studies have examined the markers for the long-term outcomes of migraine, the actual mortality risk in patients with migraine has remained unclear so far (Harnod, Cheng, and Chia, 2008). The three-item ID-Migraine™ questionnaire screener was found to be a valid and reliable screening instrument for migraine headaches. Its ease of use and operating characteristics suggest that it could significantly improve migraine recognition in primary care (Lipton et al., 2003). Therefore, in our study, we are using ID-Migraine to screen for migraine among the medical students.

A smartphone is one of the most popular devices among adolescents. According to the data from Statista, the number of smartphone users worldwide today exceeds 3 billion and is estimated to continue to rise by several hundred million in the coming years while for 2020, the number of smartphone users in Malaysia is estimated to reach 30.41 million compared to 18.4 million in 2019. The countries with the largest number of smartphone users are China, India and the United States, with each country comfortably hitting the 100 million user mark. Advancement in smartphone models, including portable media players, compact digital cameras, access to emails, GPS navigation units and high-resolution touch screens, contribute to the frequent use and addiction to smartphones (Kwon et al., 2013).

Frequent use of the smartphone causes an individual to become obsessed with his/her smartphone, called smartphone addiction. According to Sahu, Gandhi and Sharma (2019), the prevalence of problematic mobile phone use was found to be 6.3% in the overall population (6.1% among boys and 6.5% among girls), whereas another study found 16% among the adolescents. The review finds that excessive or overuse of mobile phone was associated with feeling insecurity; staying up late at night; impaired parent–child relationship; impaired school relationships; psychological problems such as behavioural addiction like compulsive buying and pathological gambling, low mood, tension and anxiety, leisure boredom, and behavioural problems, among which most pronounced association was observed for hyperactivity followed by conduct problems and emotional symptoms. According to Radiological Society of North America (2017), Hyung Suk Seo, M.D., professor of neuroradiology at Korea University in Seoul, South Korea, and colleagues used magnetic resonance spectroscopy (MRS) to gain unique insight into the brains of smartphone- and internet-addicted teenagers. MRS is a type of MRI that measures the brain's chemical composition. The researchers performed MRS exams on the addicted youth prior to and following behavioural therapy and a single MRS study on the control patients to measure levels of gamma aminobutyric acid, or GABA, a

neurotransmitter in the brain that inhibits or slows down brain signals, and glutamate-glutamine (Glx), a neurotransmitter that causes neurons to become more electrically excited. Previous studies have found GABA to be involved in vision and motor control and the regulation of various brain functions, including anxiety. The results of the MRS revealed that, compared to the healthy controls, the ratio of GABA to Glx was significantly increased in the anterior cingulate cortex of smartphone- and internet-addicted youth prior to therapy. Since researchers have found an imbalance in the brain chemistry of young people addicted to smartphones and the internet, migraine could be one of the complications of that. We are using a Smartphone Addiction Scale (SAS) to identify the presence of smartphone addiction among medical students.

There is a study published in the medical journal 'Neurology: Clinical practice' with the objective of determining the association of smartphone use with occurrence of new-onset headache and/or increased severity of headaches in patients with primary headache. Researchers studied 400 people in India with headaches which included migraines, tension headaches and others. The study suggests that smartphone users were more likely to use pain medication for headaches and find less relief than those who didn't use smartphones (Uttarwar et al., 2020). This may suggest that migraineurs with smartphone addiction who have smartphone addiction are experiencing much worse migraine compared to migraineurs without smartphone addiction. Therefore, the objective of our study is to find out the relationship between migraine and smartphone addiction among university students in Malaysia using cross sectional study methods.

1.2 Problem Statement

Nowadays, a smartphone is a daily necessity. There is no denial that smartphones bring a lot of benefits mainly through communication and getting information. However, smartphones have drawbacks such as decreased job performance, social negative personal interest, and psychological addictions (Parasuraman, Sam, Yee, Chuon, & Ren, 2017).

A study conducted on both undergraduate (UG) and postgraduate (PG) medical students on the impacts of excessive usage of smartphones showed that significantly more undergraduates reported to have light headaches and chronic headaches after repeated use of the smartphone (Harshe, et al. 2017). Harshe, et al. (2017) added that the causation of the results is due to more frequent use of WhatsApp, Facebook, Games and Youtube among the UGs group compared to the PGs.

As of today, a lot of research has been done on the burden and impacts of migraine towards students. The main impact of migraine is that it affects the quality of life of the student. Other than that, Menon & Kinnera (2013) believes that migraine affects the student's academic and social interaction among others. Besides students suffering from intense headaches other symptoms known were dizziness, allodynia and stiffness of the neck (Menon & Kinnera 2013). Even though migraine among students has been identified, only a few seek medical treatment. The results of a study conducted by Ojini, Okubadejo, & Danesi (2009) showed that, Only 4.6 per cent sought medical help, while 68.2 percent sought non-prescription drugs, mostly simple analgesics. Menon & Kinnera (2013) discussed that the trigger factors of migraine were mainly bad sleeping cycle, emotional stress, frequent change of weather patterns and head movement. A research conducted by Macgregor, Brandes, Eikermann, & Giammarco (2004), illustrates the substantial burden of migraine on patients and families / cohabitants, not only reflecting

decreased productivity and work/school absences but also losing time from family/social occasions.

Until this date, there has not been a single study between the association of migraine and smartphone addiction among students in Malaysia. It is important for people to know that prolonged usage of smartphones could lead to migraine as migraine gives a huge impact on someone's quality of life and well-being. It is important for the students to identify they have migraines and seek medical attention as soon as possible.

1.3 Significance of Study

The results of this study have advantages for society, especially medical students. This is because the study helps them to understand the meaning of migraine and smartphone addiction. If they find that they are having migraine or smartphone addiction, they can take preventive measures to reduce it. Smartphone addiction can impact the life of a person if not controlled and migraine pain causes a person to suffer with headaches and it affects their daily life routine. Through this study, the impacts of migraine on the quality of life of the smartphone addicts can be concluded. Comparison between the impact of migraine in terms of smartphone vs non smartphone participants can be obtained through this study. This would greatly help the people with migraine to understand the consequences of smartphone addiction and on how to prevent it.

The finding of this study will be very useful for the treatment purposes and references for healthcare professionals in the future. Based on the existing studies, the close association between smartphone addiction and migraine can cause serious health conditions such as sleep deprivation among the medical students. Thus, it is crucial to diagnose any symptoms of migraine and smartphone addiction before it impacts the quality of life of students. Through this study, students will be able to recognize any symptoms related to migraine and they take

preventive measures to cure it. Besides, high prevalence of smartphone addiction was noted among the medical students. So, preventive measures can be taken among the students.

Apart from that, this study will be beneficial for smartphone addicts with recurring headaches among the students. This is because students who suffer from headaches could identify that they possibly have migraine and they could stop their condition before it gets severe. If smartphone addicts have migraines, they can seek medication from health professionals to cure the migraine. Thus, the findings of this study can be really useful for those students to detect, manage and control their migraine and smartphone addiction as soon as they start to notice the symptoms. Students with migraine who already knew they were affected with this migraine can acknowledge the severity of migraine in them. Their prior knowledge on migraine and smartphone addiction with the finding of this study will really help them to change their behaviour. In addition, students could assess their smartphone addiction and migraine through the smartphone addiction scale and ID Migraine self -questionnaire from the study. This will be really helpful for them to identify possible migraine conditions or smartphone addiction. As a result, they will not procrastinate because of the long-term negative effects of the migraine condition and smartphone addiction such as drop in academic performances.

1.4 Research Questions

1. What is the prevalence of smartphone addiction among medical students in University Putra Malaysia, (UPM)?
2. What is the prevalence of migraine among medical students in University Putra Malaysia, (UPM)?
3. What is the frequency of migraine, severity and impact of migraine among medical students in University Putra Malaysia, (UPM)?
4. What are the clinical characteristics of migraine (presence of aura, medication taken, the current headache is related to any recent event and severity of disease) and days per month medications taken for acute headache among medical students in University Putra Malaysia, (UPM)?
5. Is there any association between sociodemographic factors and migraine among the medical students in University Putra Malaysia, (UPM)?
6. Is there any association between smartphone addiction and migraine among the medical students in University Putra Malaysia, (UPM)?
7. Do migraineurs with smartphone addiction have worse migraine status than migraineurs without smartphone addiction?

1.5 Objectives:

1.5.1 General Objective

To determine the relationship between smartphone addiction and sociodemographic factors on migraine among students of a public university in Malaysia.

1.5.2 Specific Objectives

1. To determine the prevalence of smartphone addiction among medical students in University Putra Malaysia, (UPM).
2. To determine the prevalence of migraine among medical students in University Putra Malaysia, (UPM).
3. To analyse the clinical severity, frequency and impact (monthly headache days, pain scale of migraine and disability) of migraine among medical students with and without smartphone addiction.
4. To analyse the clinical characteristics of migraine (presence of aura, medication taken, the current headache is related to any recent event and severity of disease) and days per month medications taken for acute headache among medical students in University Putra Malaysia, (UPM).
5. To determine the association of sociodemographic factors on the migraine among medical students in University Putra Malaysia, (UPM).
6. To determine the association of smartphone addiction and migraine among medical students in University Putra Malaysia, (UPM).
7. To analyse whether migraineurs with smartphone addiction have worse migraine than migraineurs without smartphone addiction?

1.6 Hypothesis

1.6.1 Null Hypothesis

- There is no significant association between gender and migraine among medical students in University Putra Malaysia.
- There is no significant association between year of study and migraine among medical students in University Putra Malaysia.
- There is no significant association between family income and migraine among medical students in University Putra Malaysia.
- There is no significant relationship between smartphone addiction and migraine among medical students in University Putra Malaysia.
- There is no significant association between smartphone addiction and migraine severity among the migraineurs

1.6.2 Alternative Hypothesis

- There is a significant association between gender and migraine among medical students in University Putra Malaysia.
- There is a significant association between year of study and migraine among medical students in University Putra Malaysia.
- There is a significant association between family income and migraine among medical students in University Putra Malaysia.
- There is a significant relationship between smartphone addiction and migraine among medical students in University Putra Malaysia.
- There is a significant association between smartphone addiction and migraine severity among the migraineurs.

CHAPTER 2

LITERATURE REVIEW

2.1 Migraine

2.1.1 Definition of migraine

According to the International Classification of Headache Disorders 3rd edition (ICHD-3), migraine is a common disabling primary headache disorder diagnosed by its pain and number of attacks (at least 5, lasting 4-72 hours if untreated). Based on the ICHD-3, migraine starts in childhood, and peaks in adolescence. Bilateral migraine headache is very common in children and adolescents (aged under 18 years) compared to adults and migraine pain arises from the frontotemporal area (ICHD-3).

Migraine can be generally classified into 2 main types which are migraine with aura and migraine without aura. Migraine with aura is a headache which is preceded by aura. Migraine without aura is when the patient experiences a headache without an aura. This is 5 times more common than migraine with aura. Aura is a reversible neurological disturbance which occurs during or after migraine attacks (ICHD-3). Several characteristics distinguish common migraine (migraine without aura) from the migraine with aura. Common migraine has a pulsating pain at the unilateral side. The intensity of the pain can be either moderate or severe and it can be exacerbated by physical activity. During the pain, the person may feel nauseous with or without vomiting. In some cases, the migraine patient could not tolerate loud noises (phonophobia) or bright light (photophobia) especially in children.

In addition, some patients may experience migraines with aura which is also called classic migraine. Migraine aura generally lasts for an hour but migraine with typical aura could also occur without any headache. In some cases, patients experience migraine without aura although they previously had migraines with aura. The aura symptoms occur in series with each individual aura symptom lasting from 5 to 60 minutes. At least, one of the aura symptoms is unilateral or it may spread gradually over the period of 5 minutes or more. Visual aura is the most common type of aura. Temporary visual disturbances such as flashes of zig-zag lines will appear at the point of fixation which then slowly spread before disappearing. Other reversible aura symptoms include sensory, motor, brainstem, speech and/or language and retinal. Sensory disturbances are described as the pins and needles sensation which radiates from the point of origin to affect a part of the unilateral side of the body, face and/or tongue.

Hemipelagic migraine is a migraine with aura which causes motor weakness. It is familial and classified into four categories which are familial hemipelagic migraine 1 (FHM1), familial hemipelagic migraine 2 (FHM2), familial hemipelagic migraine 3 (FHM3) and familial hemipelagic migraine with no mutation on the CACNA1A, ATP1A2 or SCN1A genes. FHM1, FHM2 and FHM3 demonstrate mutation on the CACNA1A, ATP1A2 or SCN1A genes respectively.

Chronic migraine is the headache which occurs for 15 days or more per month for more than 3 months, which persists for at least 8 days in the same month. Headache occurring less than 15 days in a month is considered as episodic migraine. In the chronic migraine it is hardly possible to distinguish the individual headache in a person with continuous migraine. Migraine pain causes several complications. In a patient, migraine attack can persist for more than 72 hours which is termed as status migrainosus. It can greatly affect someone to carry out the daily routine properly as the pain is constant for more than 2 days. Besides, other patients experience

seizure due to migraine with aura. This phenomenon is very rare and the seizure is triggered during or after the migraine attack. In some cases, patients with migraine develop the risk of ischemic stroke. A large body of evidence supports the link between migraine and ischemic stroke. The subset of patients at the most increased risk of stroke are young females with migraine with aura (Anna Gryglas and Robert Smigiel, 2017). Migraine with aura also may cause aura symptoms to persist for one week or more without any brain infarction. The pain will be bilateral and may last for months.

2.1.2 Prevalence of Migraine

Global Burden of Disease Study found migraine to be the second highest cause of years lost due to disability, interfering significantly with occupational, educational, household, family, and social responsibilities. Migraine is the second highest contributor to neurological disease burden, after stroke (GBD 2015 Neurological Disorders Collaborator Group, 2017).

A review was done to determine the unmet needs for migraine in East Asian adults and children. 41 out of 1337 publications that met the inclusion criteria (28 from China, 7 from Japan, and 6 from South Korea) were retrieved. Results show that the 1-year prevalence of migraine (IHS criteria) among adults ranged from 6.0% to 14.3%. Peak prevalence ranged from 11% to 20% for women and 3% to 8% for men (30- to 49-year-olds). For children, prevalence of migraine increased with age (Takeshima et al., 2019). Besides that, according to Lipton et al. (2007), the 1-year period prevalence in the United States for migraine was 11.7% (17.1% in women and 5.6% in men). Prevalence peaked in middle life and was lower in adolescents and those older than age 60 years.

Migraine also happens frequently among medical students. A survey in 2014 at one of the medical schools in the United States of 359 medical students reported that there are eighty-nine (24.8%) self-reported migraine, and all were confirmed by reported symptoms. Of these students, 54% had a physician-confirmed diagnosis. About half of migraineurs reported one or more attacks monthly. Stress and sleep disturbances were the most common triggers. Pain severity was rated 7 or higher on a 10-point scale by 73% (Johnson, H., Guhl, G., Arora, J., & Walling, A.). Besides that, another study was done among medical students in Kuwait University. According to Al-Hashel, Ahmed, Alroughani and Goadsby (2014), migraine headache was suggested in 27.9% of subjects based on ID-Migraine™. Migraine prevalence, frequency and severity of headache were significantly increased among students in the last 2 years compared to the first five years of their study. Stress 43 (24.9%), irregular sleep 36 (20.8%), and substantial reading tasks 32 (18.5%), were the most common triggering factors cited by the students.

2.1.3 Impact of Migraine

Migraine has always been one of the major health issues concerning the world population. People suffering from migraines experience a significant decline in their quality of life. Migraine is ranked as the seventh most disabled disease among all diseases worldwide (responsible for 2.9% of all years of life lost to disability) and the leading cause of disability among all neurological disorders. According to, World Health Organization (WHO), migraine is caused by the activation of a mechanism deep in the brain that leads to release of pain-producing inflammatory substances around the nerves and blood vessels of the head. Migraine is three times more common to happen in women than men due to interference of hormones.

Besides adults, about 10% of children suffer from migraine and 28% adolescents at the age between 15-19 also suffer from this problem.

Migraine has become a public health issue as it gives a huge impact towards social and economic consequences. About $36 billion is estimated for the cost of healthcare and lost productivity associated with migraine annually in the U.S. Families with a migraine sufferer have a 70% increase in their healthcare cost compared to a non-migraine affected family. In the U.K. the National Health Service (NHS) spends up to £150 million per year for the cost of migraine; made up mostly for the cause of visits to general practitioners and price of prescription drugs. In addition, an estimation of £250 million per year was made on the NHS expenditure of all headache disorders ("Headache Disorders - not respected, not resourced"). A research conducted by Steiner, et al. (2003) proved that, migraine absenteeism alone costs £2.25 billion per year in the UK, calculated on the basis of 25 million days lost.

Migraine causes loss of productivity in daily routines and it has been aware these days, women accounted for the majority of this problem. According to Bruch, Loder, Loder, & Smitherman (2015), migraine and headache are leading causes of outpatient and ED visits and remains a significant public health issue, especially among women during their reproductive years. Linet et al discovered that the study among adolescents and young adults on headaches reported that the average duration of the subjects' most recent headache was 5.9 hours for males and 8.2 hours for females. Out of all the subjects, 7.9% of male and 13.9% of females stated that they missed part of a day or more of school or work because of that headache. Besides adults, migraine also gives a huge impact among children and adolescents. According to Arruda & Bigal (2012), children who experience from episodic migraine and chronic migraines are expected to have poor performance in school compared to those children without headaches and was significantly influenced by severity ($p < 0.001$) and duration ($p < 0.001$) of headache

attacks, by abnormal scores of mental health ($p < 0.001$), and by nausea ($p < 0.001$), as well as by headache frequency, use of analgesics, and gender.

2.1.4 Assessing the Impact of Migraine

Quality of life is the perception of an individual's position in life associated with his objectives, expectations, interests, and standards of life. Health-related quality of life (HRQOL), on the other hand, includes satisfaction with his health and emotional reaction to his state of health. Headaches both worsen quality of life of individuals and place a significant burden on the society. There are some questionnaires that were developed in assessing how migraine has affected the quality of life of one.

The International Classification of Headache Disorders 3rd edition (ICHD-3) is referred to as the gold standard for the clinical diagnosis of migraine. In this study, questionnaires will be used to screen migraine and to evaluate the disability caused by migraine among the participants. There are several available self-administered questionnaires to screen migraine. First, ID- Migraine is a self-administered questionnaire to screen migraine. It is a 3 item screening test consisting of disability, nausea, and sensitivity to light developed by RB Lipton, D Dodick, R Sadovsky, K Kolodner, J Endicott, J Hettiarachchi and W Harrison. In addition, the Structured Migraine Interview (SMI) and Migraine Screen Questionnaire (MS-Q) are other valid and reliable questionnaires for screening migraine. It is based on the criteria for the International Classification of Headache Disorder.

In this study, the ID-Migraine self-questionnaire was chosen to screen for migraine among the participants. In the Id migraine validation study, it is concluded that Id Migraine is a valid and reliable instrument with a sensitivity of 0.81 (95% CI, 0.77 to 0.85), a specificity of 0.75 (95% CI, 0.64 to 0.84), and positive predictive value of 0.93 (95% CI, 89.9 to 95.8).

The reliability of this test was good, with a kappa of 0.68 (95% CI, 0.54 to 0.82). The sensitivity and specificity of the three-item migraine screener was similar regardless of sex, age, presence of other comorbid headaches, or previous diagnostic status. (Lipton RB, Dodick D, Sadovsky R, et al., 2003). Moreover, the questionnaire is also easier to answer as it contains 3 questions only. If a participant answers yes from 2 out of 3 of the questions, it means that the participant might face some migraine conditions.

There is a migraine-specific quality of life scales developed to reflect the impact of migraine which is Migraine disability Assessment Scale (MIDAS). The MIDAS Questionnaire was developed to assess headache-related disability with the aim of improving migraine care. The MIDAS evaluates the extent to which headache in patients diagnosed with migraine affected their lives in the last 3 months. According to these questions, patients indicate the number of days they were unable to go to school/work, do housework and had decreased efficiency. It is graded as 'no disability' due to migraine if the total score is 0–5, 'low-level disability' for 6–10 score, 'medium-level disability' for 11–21 score and 'severe disability' for >21 score (Demir and Sumer, 2019). In our study, we'll be using the MIDAS questionnaire to evaluate the severity of Migraine among the migraineurs.

2.2 Smartphone Addiction

2.2.1 Definition of Smartphone Addiction

A smartphone is "a mobile phone that performs many of the functions of a computer, typically having a touch screen interface, internet access, and an operating system capable of running downloaded applications" (Oxford Dictionaries, 2016). Smartphone applications (apps) are endless and their use includes entertainment, communication, information seeking and etc (Boumosleh & Jaalouk, 2017). However, frequent use of the smartphone causes an individual

to become obsessed with his/her smartphone (Gutiérrez, Fonseca, & Rubio, 2016). Children and students are more addicted to smartphones compared to adults, as they were introduced to them at an early age and they are the major class for smartphone advertising. According to statistics by age group, children's smartphone usage is 35% among those aged 3–4 years, 38% for 5–7 years, 75% for 8–11 years, and 86% for 12–15 years (Ofcom 2017).

Given that smartphone usage in Malaysia has increased rapidly, it is important to use the correct scale for measuring smartphone addiction. With the Smartphone Addiction Scale (SAS) questionnaire, smartphone addiction could be easily recognized. SAS is a questionnaire consisting of 33 items which is divided into six subscales: daily-life disturbance, positive anticipation, withdrawal, cyberspace-oriented relationship, overuse, and tolerance. SAS uses the 6-point Likert-type scale with each question having a response scale from 1 to 6 (1 = strongly disagree, 2 = disagree, 3 = slightly disagree, 4 = slightly agree, 5 = agree and 6 = strongly agree) depending on the prevalence of the symptoms. Respondents would tick on the scale that reflects the closest statement of their smartphone use characteristics. Upon this SAS, the total possible score could range from 48 to 288. The higher the score, the greater the smartphone's degree of pathogenic use.

2.2.2 Prevalence of Smartphone Addiction

There has been a rapid increase in the use of smartphones due to its multiple benefits, Smartphones have become a necessity in daily life to the point that it has become an addiction. This leads to the rise in the prevalence of smartphone addiction worldwide.

One study which includes 6 Asian countries (China, Hong Kong, Japan, South Korea, Malaysia, and the Philippines) showed that 62% of adolescents own smartphones (Mak KK, Lai CM, Watanabe H, et al., 2014). In Switzerland, it was reported that 97.6% of adolescents own smartphones (Haug S, Castro RP, Kwon M, et al 2015). So, considering the higher number of people using smartphones, it leads to higher prevalence of addiction. In Switzerland, the prevalence of smartphone addiction among adolescents was reported to be 16.9% (Haug S, Castro RP, Kwon M, et al., 2015). In a similar study from Riyadh, 76% of moderate to high risk of smartphone and internet addiction were seen among the participants (Alosaimi, F. D.,2016). A German study by Aggarwal M, Grover S, Basu D in 2015 found that 27.1% were smartphone addicts among the enrolling resident doctors. This study concluded that smartphones were the important tool for them to communicate with friends and families during long work periods. Another study by a Indian meta-analysis concluded that 39% to 44% of participants are smartphone addicts (Davey S., Davey A., 2014). This is because people tend to spend their leisure time using smartphones and this causes a rise in smartphone usage thus the addiction.

According to Lee H, Ahn H, Choi S and Choi W in 2014, the severity of smartphone addiction is closely related to increasing frequency and time spent on smartphones. In a study which includes 164 US college undergraduates, it was found that female respondents spent longer time using smartphones in a day compared to males (Roberts et al. 2014). The results of this study resonate well with another study conducted in 2015 that females have longer period of smartphone usage especially WhatsApp compared to men, calculated that females use WhatsApp about 13 min longer than males per day (Montag C., Błaszkiewicz K., Sariyska R., et.al.). Besides gender, age also contributed to WhatsApp usage. Younger participants have longer WhatsApp usage in a day. The same study demonstrated that duration of smartphone usage and time until first use in the morning acts as a better scale for smartphone addiction than

smartphone usage frequency. (Montag C., Błaszkiewicz K., Sariyska R., et.al.). This finding was in contrast to the research conducted by Lin et al. in 2015 showing that smartphone addiction is strongly associated with its use frequency compared to duration.

Although many researches and studies have shown that smartphone usage leads to addiction, there are some benefits of using smartphones. A study found that mobile applications offer several promising ways to prevent and treat chronic diseases such as diabetes (Arsand E., Muzny M., Bradway M., Muzik J. and Hartvigsen G., 2015) and alcoholism (Gustafson et al., 2014).

2.2.3 Impact of Smartphone Addiction

Smartphone addiction impacts the life of a person in many ways. A study conducted by Chaudhury, P., & Kumar Tripathy, H. (2018) deduced that academic performances and smartphone addiction have a negative correlation. They found that better internet connection such as 4G connection leads students to use smartphones more thus getting addicted to it. This causes them to neglect their studies. So, smartphone addiction causes a drop in student's academic performances.

Besides, the result of another study conducted by AlAbdulwahab, S. et.al in 2017, showed a coherent association between smartphone addiction and various degrees of neck disability among the participants. The Spearman correlation coefficient showed a significant correlation ($p < 0.05$) between smartphone addiction scale (SAS) and neck disability index (NDI) scores among 78 healthy participants. Another study proves that frequent and prolonged neck flexion during smartphone use causes neck pain and disability (Bababekova, Rosenfield, Hue & Huang, 2011). These findings prove that smartphone use causes physical disability.

In addition, smartphone addiction also leads to sleep disruptions and insomnia. Jocelyne Matar Boumosleh and Doris Jaalouk in 2007 stated that 35.9% of the study sample reported to be tired during daytime due to smartphone use till late night. 38.1% of them acknowledged that their quality of sleep has declined, and 35.8% admitted that they have sleep duration of less than four hours due to smartphone overuse. In a sample of 319 university students in Turkey, smartphone addiction scores showed remarkable positive correlation with sleep disturbance and daytime dysfunction (Demirci K., Akgönül M. and Akpinar A, 2015). Likewise, in 2015 Lemola S. et. al carried out a study consisting of 362 Swiss high school students and found out that students had delayed bedtimes due to smartphone addiction and experienced more sleep difficulties and less sleep duration on weekdays. Jenaro et al. (2007), found that t the mobile phone use was associated with high anxiety and insomnia. Headache is the most frequent cause due to uncontrolled mobile phone use followed by sleep disorder, tension, vertigo and fatigue. Massimini and Peterson (2009) states that, majority of the students lack sleep due to mobile phone use on at least one day of the week.

Apart from that, smartphone addiction may lead to depression and anxiety. The association between depression or anxiety and smartphone addiction was established among young adults as well as the older adult population. In a mixed sample of 274 adults aged 16–59 years, depression and anxiety had an outstanding positive correlation with smartphone addiction. The findings resonate well with findings from a study sample consisting of 325 Taiwanese adults ranging from 17–97 years, revealed a statistically notable positive effect of social interaction anxiety on smartphone-related compulsive use (Lee Y.K., Chang Y.L, Cheng Z.H, 2014). In a sample of 353 Korean college students, depression emerged as a significant independent positive predictor of smartphone addiction] (Al-Khlaiwi T., Meo S.A.,2004)

2.3 Association between Smartphone Addiction and Migraine

Smartphone use can cause migraines, headaches, and other symptoms, including dizziness, eye strain, neck pain, and more. While some studies have suggested that smartphone use causes migraines and no other headaches, there is strong evidence linking mobile phones with a variety of symptoms, including non-migraineurs headaches.

Headache was the commonest reported complaint due to smartphone use. Association between smartphone use and primary headache had been supported by a cross sectional study of 400 people consisting of smartphone users (SU) and non-smartphone users (NSU). There are higher occurrences of aura among the smartphone users to non-smartphone users, (NSUs: 15 [7.7%] vs SUs: 36 [17.5%]; $p = 0.003$).There was also higher proportion of patients taking analgesics (NSUs: 157 [80.9%] vs SUs: 197 [95.6%]; $p < 0.001$), with less relief in headache with medication in the smartphone users group (Uttarwar et al., 2020). The study concluded that the use of smartphones was associated with an increase in the requirement of acute medication and less relief with acute medication. The study author Deepti Vibha (2020), from AIIMS in New Delhi suggested that the results need to be confirmed with larger and more rigorous studies, the findings are concerning, as smartphone use is growing rapidly and has been linked to a number of symptoms, with headache being the most common.

2.4 Socio-demographic Factors

2.4.1 Gender

A study conducted on medical students in Kuwait shows that females have a higher tendency to get migraines compared to male. It was recorded that there were high prevalence of migraine in female with a frequency of 136 out of 437 female medical students as compared to male

medical students with a frequency of 37 out of 184 male medical students (Al-Hashel, Ahmed, Alroughani, & Goadsby, 2014).

The same study was conducted on the medical students from Jazan University. 258 out of 260 total participants, 128 of them were male and 130 was female also proves that the prevalence of migraine in females (61.5%) is higher than male (38.5%) (Akour, Shabi, & Ageeli, 2018). The prevalence of migraines was 1.5 times greater in females than in males. Similarly, another study done in King Abdulaziz University, Jeddah, Saudi Arabia also shows that migraine prevalence among women (33.2%) was much higher than males (15.5 %), with a highly significant statistical difference ($X2 = 21.93$, $p < 0.001$) (Ibrahim, et al., 2017).

2.4.2 Year of study

Based on a research done in Kuwait University by (Al-Hashel, Ahmed, Alroughani, & Goadsby, 2014) the prevalence of migraine was recorded among medical students from grade 1 to grade 7; grade 1 (31.1%), grade 2 (25.0%), grade 3 (21.1%), grade 4 (14.8%), grade 5 (26.5%, grade 6 (35.5%) and grade 7 (44.0%). The migraine prevalence was proved to be the highest in seventh grade followed by sixth grade. The high incidence of migraine in the last two grades most probably explained by the high frequency of examinations associated with the increasing stress, irregular sleep pattern and many hours of reading; which triggers the development of headache. However, the prevalence of migraine among the first grade was also high. Likely due to the emotional stress faced by the first-grade students who need to thrive in order to remain in Medicine.

In a separate study conducted in a Saudi Arabian university, the prevalence of migraine headache among students enrolled in the second academic year was much higher compared to other years (OR= 2.24; 95% CI: 1.39-3.59) (Ibrahim, et al., 2017). The prevalence of migraine

headache among students enrolled in the second academic year was 40.9% out of 478 while other years were 23.6% out of 115.

Meanwhile, in another research done in Jazan University, different results were shown. The prevalence of migraine increased with progression in the years studied; second year, third year, fourth year, fifth year and sixth year with a percentage of 7.7%, 0%, 15.4%, 38.5 and 38.5% respectively with a p-value of 0.008 (Akour, Shabi, & Ageeli, 2018).

2.4.3 Family Income

Based on Stewart, Roy and Lipton (2013), a higher prevalence of migraine has been reported consistently among lower income or lower education groups in the United States. Exceptions are likely to be clarified by limited studies, low income volatility or high social support rates. While low income has a direct effect on health, household (HH) income itself is also a surrogate to a number of social, psychological, and physical exposures, some of which may mediate the onset of migraines. The fact that migraine incidence is related to HH income may suggest that the aetiology of migraine onset is strongly related to exogenous factors. For example, physical and psychological stress may contribute to migraine onset, as the frequency of stressful events is known to be more common in lower HH income groups and these same factors may mediate variation in attack frequency (Stewart, Roy and Lipton, 2013). Exogenous mediators may also differ by sex. For example, women in lower income groups may be more likely to experience abuse or neglect than men, factors known to influence migraine prevalence (Stewart, Roy and Lipton, 2013). According to the results from Stewart, Roy and Lipton (2013), migraine prevalence increased as HH income decreased for females ($\chi 2$, $p < 0.01$) and males ($\chi 2$, $p < 0.01$). Study by Fernández-de-las-Peñas et al. (2010) among the Spanish adults, also found that migraine was more common in those of lower income. factors.

2.5 Conceptual Framework

Figure 2.1 shows the association of migraine and smartphone addiction among medical students in University Putra Malaysia, (UPM) 2020. Based on the literature review, we have identified that smartphone addiction could be a possible factor causing migraine among medical students of University Putra Malaysia. Besides smartphone addiction, the possible factors comprising socio-demographic characteristics (gender, year of study and income) were listed to be associated with migraine among the medical students. Other factors that contribute to migraine but not included in the research is also stated inside the conceptual framework.

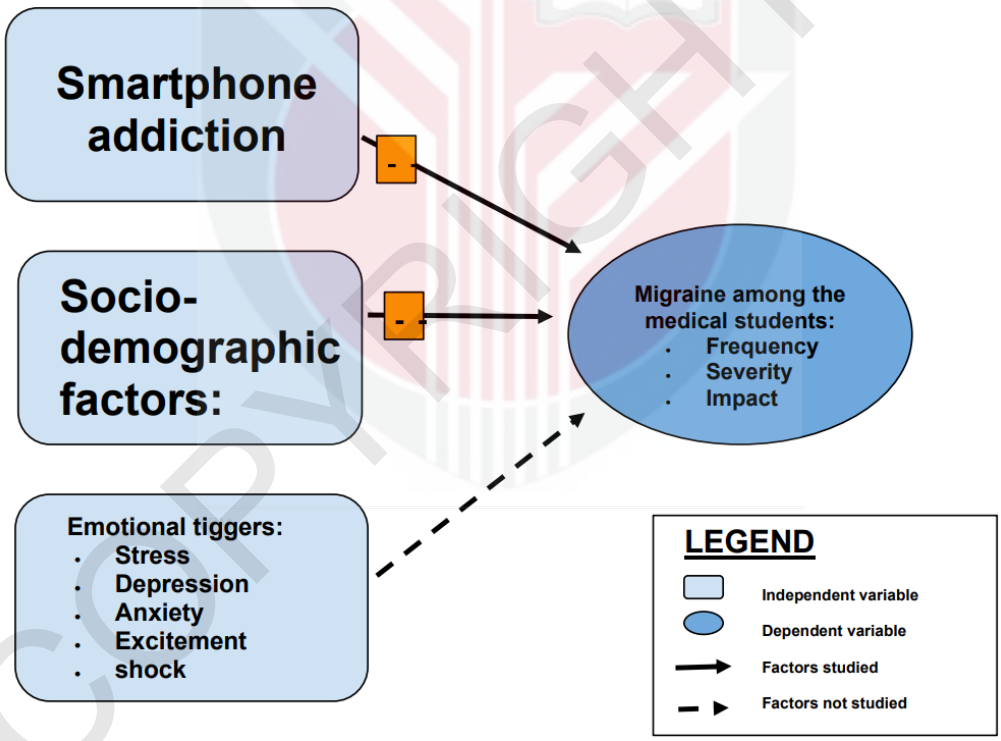

Figure 2.1: The conceptual framework of relationship between smartphone addiction and socio-demographic factors on migraine among medical students in UPM.

CHAPTER 3

METHODOLOGY

3.1 Study Location

The study was held in the Faculty of Medicine and Health Sciences (FMHS), University Putra Malaysia (UPM), Serdang, Selangor.

3.2 Study Design

This study used a cross sectional design.

3.3 Study Duration

The study was conducted from 1st June 2020 until 9th October 2020. The data collection was distributed and collected from 17th August 2020 until 24th August 2020.

3.4 Sampling

3.4.1 Study Population

Year 1 to Year 5 medical students in University Putra Malaysia, UPM (2020) in Serdang were included in this study.

3.4.2 Sampling Population

3.4.2.1 Inclusion Criteria

- Year 1 to year 5 medical students of Faculty of Medicine and Health Sciences, University Putra Malaysia.
- Medical students who own a smartphone.

3.4.2.2 Exclusion Criteria

- Medical students who are on medical leave or drop out during the research.

3.4.3 Sampling Frame

A list of year 1, year 2, year 3, year 4 and year 5 medical students who study in the Faculty of Medicine and Health Sciences in University Putra Malaysia (UPM) in 2020.

3.4.4 Sampling Unit

A student who fulfils the inclusion and exclusion criteria.

3.4.5 Sampling Method

Random sampling was used.

3.4.6 Sample Size Estimation

$$n = \frac{[Z_{1-\alpha/2}\sqrt{2}\,P\,(1-P) + Z_{1-\beta}.\sqrt{\{P_1(1-P_1) + P_2\,(1-P_2)\}}]^2}{(P_1-P_2)^2}$$

where $P=(P_1+P_2)/2$

= {1.96√2(0.666)(1 − 0.666) + 0.842√0.806(1 − 0.806) + 0.526(1 − 0.526) }^2

(0.806-0.526)^2

n = 46

with 2 proportion group and 20% attrition, the sample size is n = 111

Where:

n = sample size estimate

z(1-α/2) = standard error associated with 95% confidence interval = 1.96

z(1-β) = standard error associated with 80% power = 0.84

P1 = Proportion of female with migraine = 0.806 (Balaban et al., 2012)

P2 = Proportion of male with non-migraine = 0.526 (Balaban et al., 2012)

P= (P1+ P2) ÷ 2

P= 0.666

	Migraine	Non-migraine	
Female	25 (80.6%)	102 (47.4%)	127 (51.6%)
Male	6 (19.4%)	113 (52.6%)	119 (48.4%)
	31	215	246

(Balaban et al., 2012)

3.5 Variables

3.5.1 Dependent Variables

Migraine among medical students in University Putra Malaysia (UPM).

3.5.2 Independent Variables

1. Gender
2. Year of Study
3. Family Income
4. Smartphone addiction among medical students in University Putra Malaysia (UPM).

3.6 Data collection

3.6.1 Instrument of study

A self-administered questionnaire was used. The questionnaire consists of five sections which are:

1. Section A: Socio-demographic factors
2. Section B: Smartphone Addiction Scale (SAS)
3. Section C: ID Migraine
4. Section D: Migraine Disability Assessment (MIDAS)
5. Section E: Clinical Status of Migraine.

3.6.1.1 Questionnaire

The instruments used during the data collection was a questionnaire. It consists of a few sections based on the objective of the study.

Section A: Socio-demographic factors

3 items were collected under socio-demographic factors which were gender, year of study and family income.

Section B: Smartphone Addiction Scale (SAS)

Smartphone Addiction Scale questionnaire uses a 6-point Likert-type scale with 33 questions and is divided into six subscales: daily-life disturbance, positive anticipation, withdrawal, cyberspace-oriented relationship, overuse, and tolerance. The total score ranges from 33 to 198. A higher score means a severe degree of smartphone addiction (Kwon, et al. 2013). Those scored more than are considered to have smartphone addiction. Respondents with a score less than are considered non smartphone addicts.

Section C: ID Migraine Questionnaire

The ID-Migraine questionnaire contains 3 items which are disability to perform tasks, nausea, and sensitivity to light. This questionnaire was used to screen migraine among the studied group. The questions were answered either yes or no and if two out of 3 questions were answered yes, the participant is considered to have migraine.

Section D: Migraine Disability Assessment (MIDAS)

Migraine Disability Assessment (MIDAS) Questionnaire comprises seven questions in total. Three questions assess the number of missed days due to headache in the domains of school/work, housework, and family/leisure activities (items MIDAS 1, 3 and 5). Two questions assess the number of additional days with limited productivity due to headache at school/work and housework (items MIDAS 2 and 4). The total MIDAS score is the sum of the days given as response to these five questions (MIDAS 1 to MIDAS 5). The total score ranges from 0 to 90 and is used to categorize patients in disability grades I to IV (Grade I (0-5), Grade

II (6-10), Grade III (11-20), Grade IV (21=)). A higher score means more severe disability, placing the patient in a higher disability grade.

Section E: Clinical Status of Migraine

This questionnaire consists of 5 questions consisting of the presence of aura before headache attacks, severity of migraine based on personal opinion (mild, moderate or severe pain), headache related to any events, the medication used to treat migraine among the migraineurs and number of days medication taken.

3.6.2 Data Collection Techniques

The self-administered questionnaire was set up via Google Form and distributed among selected medical students during the data collection period (17th August 2020 until 24th August 2020). Students completed it and submitted before the deadline. The researchers did a follow-up two to three days after the questionnaires were distributed. Participants were paid RM5 for their participation in this study.

3.6.3 Quality Control

3.6.3.1 Validity and reliability of questionnaire

A. Smartphone Addiction Scale (SAS)

The internal consistency and concurrent validity of SAS were verified (Cronbach's alpha = 0.967). Those for the six factors were daily-life disturbance (0.858), positive anticipation (0.913), withdrawal (0.876), cyberspace-oriented relationship (0.904), overuse (0.825), and tolerance (0.865). (Kwon, et al. 2013).

B. ID-MIGRAINE

The three-item ID Migraine questionnaire was found to be a valid and reliable screening instrument for migraine headaches. On a test, it was concluded it has a sensitivity of 0.81 (95% CI, 0.77 to 0.85), a specificity of 0.75 (95% CI, 0.64 to 0.84), and positive predictive value of 0.93 (95% CI, 89.9 to 95.8). The test-retest reliability was adequate, with a kappa of 0.68 (95% CI, 0.54 to 0.82). The sensitivity and specificity of the three-item migraine screener was same regardless of age, sex, presence of other comorbid headaches, or previous diagnostic status (R.B. Lipton et.al, 2008).

C. Migraine Disability Assessment (MIDAS)

The reliability and validity tests for the questions was tested from previous studies and claimed to be highly reliable with internal consistency, Cronbach's alpha value was 0.76 in the United States and 0.73 in the United Kingdom (Stewart et al., 1999)

3.7 Operational Definitions

Prevalence	Prevalence is the proportion of a population who have a specific characteristic in a given time period. (National Institute of Mental Health).
Episodic Migraine	Headaches occur less than 15 days in a month. (International Classification of Headache Disorders 3rd edition)
Low-frequency Episodic Migraine	Characterized by 0 to 4 headache days a month

Moderate-frequency Episodic Migraine	Characterized by 5 to 9 headache days a month
High- frequency Episodic Migraine	Characterized by 10 to 14 headache days a month
Chronic Migraine	Characterized by >15 headache days a month (International Classification of Headache Disorders 3rd edition)
Severity	Severity refers to the frequency and quality of migraine and will be assessed by using the MIDAS questionnaire.
Addiction	Addiction is a complex condition, a brain disease that is manifested by compulsive substance use despite harmful consequences. People with addiction (severe substance use disorder) have an intense focus on using a certain substance(s), such as alcohol or drugs, to the point that it takes over their life. (American Psychiatry Association)
Smartphone Addiction	Smartphone addiction is defined as an inability to control the use of the smartphone despite harmful effects including physical and psychological, financial, social harmful consequences on users. (Cha, S. S., & Seo, B. K. (2018)). Smartphone addiction will be evaluated based on the SAS- questionnaire.
Students	Medical undergraduate of University Putra Malaysia from Year 1 to Year 5.

3.8 Data Analysis

Statistical analysis was conducted using the standard statistical software package IBM SPSS Statistics V25.0 for Windows. Statistical analysis was performed using the $\chi 2$ test for categorical variables and the t-test and Wilcoxon rank-sum test for continuous variables. Continuous variables not following standard distribution were analysed with the Mann-Whitney test. Values in absolute numbers and in percentages were compared between 2 groups. Results were considered to be statistically significant if the p value is <0.05.

3.9 Study Ethics

Approval for this study was obtained from JKEUPM, the ethical committee of University Putra Malaysia. Written informed consent was obtained from eligible and consenting patients.

CHAPTER 4

DATA ANALYSIS

4.1 Pre-test Data

A pre-test was conducted based on the objectives of this research. 30 students were chosen randomly from the second-year Medical batch from University Putra Malaysia but only 29 of them agreed to participate in the pre-test. Based on the pre-test, the SAS questionnaire was reliable with the value of Cronbach's Alpha of 0.960. The ID-Migraine questionnaire was reliable with the value of Cronbach's Alpha of 0.792. The other objectives of this pre-test is to ensure that the respondents are interpreting questions correctly, and to ensure that the order of questions does not influence the way a respondent answers.

4.2 Response Rate

Google form-based questionnaires were distributed to 150 randomly chosen medical students of University Putra Malaysia using WhatsApp. However, only a total of 137 answered the questionnaire. The response rate was 91.33%. Data of all the 137 students that met both the exclusion and inclusion criteria was reviewed and recorded.

4.3 Normality Assessment

Normality assessment of continuous variables which were SAS and MIDAS questionnaires were determined statistically using Kolmogorov-Smirnov and Shapiro-Wilk test and graphically using histogram. Variables are normally distributed if the p-value of Shapiro-Wilk is more than 0.05. The Shapiro-Wilk test was used to analyse all data as it was more sensitive. Table 4.1 showed the p-value of SAS and MIDAS questionnaires. Figures 4.1 and 4.2 demonstrate the Boxplot of SAS and MIDAS questionnaires. All the p-values were less than 0.05. Hence, the results showed that the data were not normally distributed.

Table 4.1: Shapiro-Wilk test

Variables	**Shapiro-Wilk**	
	Statistic	p-value
SAS Total Score	0.975	0.012
MIDAS Total Score	0.830	<0.001

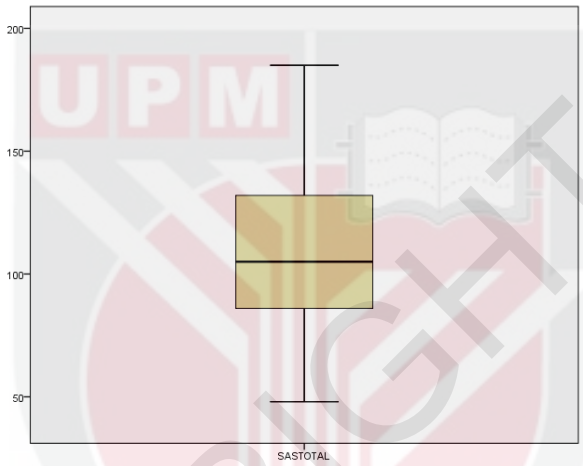

Figure 4.1: Boxplot graph of SAS Total Score

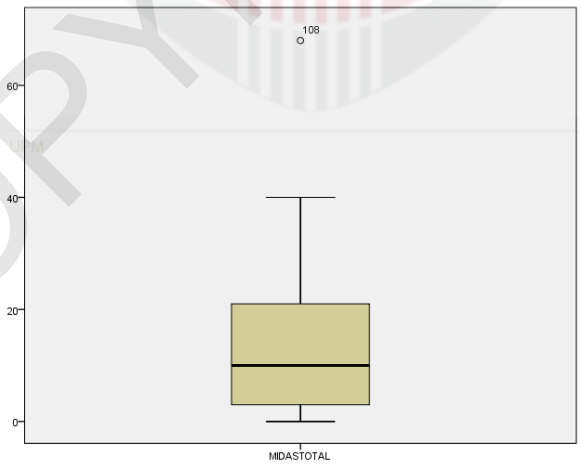

Figure 4.2: Boxplot graph of MIDAS Total Score

4.4 Sociodemographic Data

Table 4.2: Sociodemographic Data

Variables	Frequency (Percentage, %) (N=137)
Gender	
Male	49 (35.8)
Female	88 (64.2)
Year of Study	
Year 1	40 (29.2)
Year 2	27 (19.7)
Year 3	20 (14.6)
Year 4	29 (21.2)
Year 5	21 (15.3)
Family Income	
B40: < RM 3000	35 (25.5)
M40: RM 3000 – RM 6275	35 (25.5)
T20: > RM 6275	67 (48.9)

Table 4.2 shows the sociodemographic factor that has been divided into 3 categories; gender, year of study and family income of the medical students. Out of 137 students, 88 of them are female and the rest are male. The highest participation is from the 1st year medical student with a total of 40 (29.2%) students and the lowest participation is from the 3rd year medical students with a total of 20 (14.6%) students. Meanwhile for the family income, a total of 67 medical students had an income more than RM6275. As for the rest, the same number of medical

students was recorded to have a family income between RM3000 - RM6275 and below RM3000.

4.5 The Prevalence of Smartphone Addiction

Table 4.3 Prevalence of Smartphone Addiction among medical students

Smartphone Addiction	Frequency (N)	Percentage (%)
No	64	46.7
Yes	73	53.3

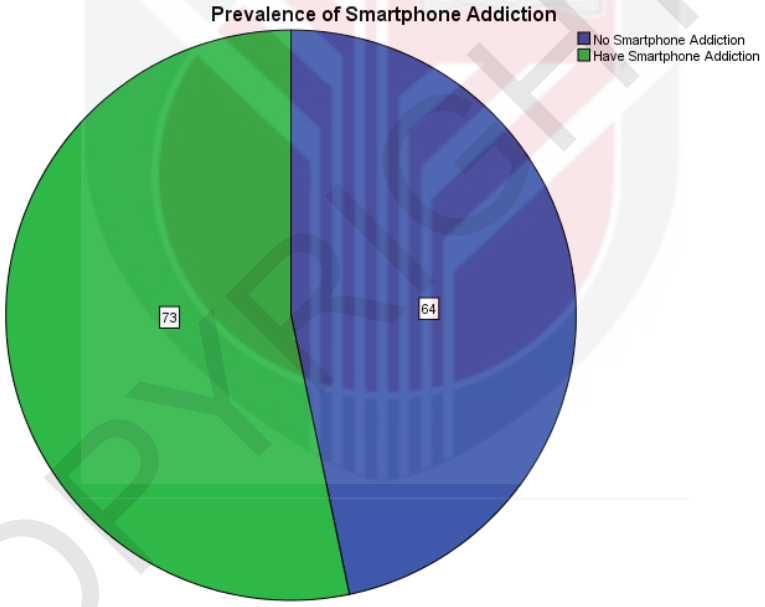

Figure 4.3: Prevalence of Smartphone Addiction among medical students

Table 4.3 shows the prevalence of smartphone addiction among medical students. The result was deduced based on the analysis of the Smartphone Addiction Scale (SAS) which consists of 33 questions and uses the Likert 6-point scale. As the data was collected from each respondent, the score was added together. Students who had a total score of 98 and above had smartphone addiction and students who had a total score of below 98 had no smartphone addiction. A total of 73 medical students were classified as having smartphone addiction and

the rest of 64 medical students had no smartphone addiction. The prevalence of smartphone addiction among the medical students was 53.3%. Figure 4.3 shows a pie chart of the prevalence of smartphone addiction among medical students.

Table 4.4: Frequency for SAS questionnaire

Variables		**Frequency (Percentage, %) (N = 137)**					
No.	**Items**	**Strongly Disagree**	**Disagree**	**Weakly Disagree**	**Weakly Agree**	**Agree**	**Strongly Disagree**
1	**Missing planned work due to smartphone use**	15 (10.9)	20 (14.6)	13 (9.5)	38 (27.7)	34 (24.8)	17 (12.4)
2	**Having a hard time concentrating in class, while doing assignments, or while working due to smartphone use**	6 (4.4)	21(15.3)	19 (13.9)	38 (27.7)	33 (24.1)	20 (14.6)
3	**Experiencing lightheadedness or blurred vision due to excessive smartphone use**	19 (13.9)	41 (29.9)	17 (12.4)	26 (19.0)	17 (12.4)	17 (12.4)
4	**Feeling pain in the wrists or at the back of the neck while using a smartphone**	15 (10.9)	36 (26.3)	24 (17.5)	32 (23.4)	18 (13.1)	12 (8.8)
5	**Feeling tired and lacking adequate sleep due to excessive smartphone use**	17 (12.4)	33 (24.1)	26 (19.0)	27 (19.7)	22 (16.1)	12 (8.8)
6	**Feeling calm or cosy while using a smartphone**	5 (3.6)	8 (5.8)	30 (21.9)	45 (32.8)	37 (27.0)	12 (8.8)

7	**Feeling pleasant or excited while using a smartphone**	4 (2.9)	15 (10.9)	20 (14.6)	39 (28.5)	46 (33.6)	13 (9.5)
8	**Feeling confident while using a smartphone**	9 (6.6)	9 (6.6)	31 (22.6)	43 (31.4)	34 (24.8)	11(8.0)
9	**Being able to get rid of stress with a smartphone**	3 (2.2)	4 (2.9)	14 (10.2)	44 (32.1)	48 (35.0)	24 (17.5)
10	**There is nothing more fun to do than using my smartphone.**	27 (19.7)	39 (28.4)	22 (16.1)	29 (21.2)	12 (8.8)	8 (5.8)
11	**My life would be empty without my smartphone.**	29 (21.2)	27 (19.7)	22 (16.1)	25 (18.2)	23 (16.8)	11 (8.0)
12	**Feeling most liberal while using a smartphone**	15 (10.9)	32 (23.4)	33 (24.1)	39 (28.5)	12 (8.8)	6 (4.4)
13	**Using a smartphone is the most fun thing to do.**	26 (19.0)	28 (20.4)	31 (22.6)	33 (24.1)	10 (7.3)	9 (6.6)
14	**Won't be able to stand not having a smartphone**	18 (13.1)	31 (22.6)	22 (16.1)	34 (24.8)	19 (13.9)	13 (9.5)
15	**Feeling impatient and fretful when I am not holding my smartphone**	24 (17.5)	42 (30.7)	24 (17.5)	30 (21.9)	12 (8.8)	5 (3.6)
16	**Having my smartphone in my mind even when I am not using it**	35 (25.5)	40 (29.2)	20 (14.6)	29 (21.2)	8 (5.8)	5 (3.6)
17	**I will never give up using my smartphone even when my daily life is already greatly affected by it.**	30 (21.9)	30 (21.9)	40 (29.2)	18 (13.1)	14 (10.2)	5 (3.6)

18	**Getting irritated when bothered while using my smartphone**	32 (23.4)	38 (27.7)	26 (19.0)	23 (16.8)	13 (9.5)	5 (3.6)
19	**Bringing my smartphone to the toilet even when I am in a hurry to get there**	58 (42.3)	26 (19.0)	15 (10.9)	18 (13.1)	11 (8.0)	9 (6.6)
20	**Feeling great meeting more people via smartphone use**	27 (19.7)	27 (19.7)	30 (21.9)	29 (21.2)	17 (12.4)	7 (5.1)
21	**Feeling that my relationships with my smartphone buddies are more intimate than my relationships with my real-life friends**	47 (34.3)	41 (29.9)	19 (13.9)	16 (11.7)	11 (8.0)	3 (2.2)
22	**Not being able to use my smartphone would be as painful as losing a friend.**	59 (43.1)	31 (22.6)	22 (16.1)	18 (13.1)	3 (2.2)	4 (2.9)
23	**Feeling that my smartphone buddies understand me better than my real-life friends**	57 (41.6)	35 (25.5)	21 (15.3)	14 (10.2)	7 (5.1)	3 (2.2)
24	**Constantly checking my smartphone so as not to miss conversations between other people on Twitter or Facebook**	29 (21.2)	20 (14.6)	31 (22.6)	27 (19.7)	19 (13.9)	11 (8.0)
25	**Checking SNS (Social Networking Service) sites like Twitter or**	22 (16.1)	18 (13.1)	16 (11.7)	30 (21.9)	32 (23.4)	19 (13.9)

	Facebook right after waking up						
26	**Preferring talking with my smartphone buddies to hanging out with my real-life friends or with the other members of my family**	59 (43.1)	34 (24.8)	20 (14.6)	18 (13.1)	3 (2.2)	3 (2.2)
27	**Preferring searching from my smartphone to asking other people**	17 (12.4)	17 (12.4)	19 (13.9)	37 (27.0)	25 (18.2)	22 (16.1)
28	**My fully charged battery does not last for one whole day.**	15 (10.9)	28 (20.4)	19 (13.9)	21 (15.3)	17 (12.4)	37 (27.0)
29	**Using my smartphone longer than I had intended**	7 (5.1)	9 (6.6)	13 (9.5)	34 (24.8)	42 (30.7)	32 (23.4)
30	**Feeling the urge to use my smartphone again right after I stopped using it**	15 (10.9)	20 (14.6)	19 (13.9)	37 (27.0)	26 (19.0)	20 (14.6)
31	**Having tried time and again to shorten my smartphone use time, but failing all the time**	10 (7.3)	22 (16.1)	24 (17.5)	31 (22.6)	30 (21.9)	20 (14.6)
32	**Always thinking that I should shorten my smartphone use time**	3 (2.2)	17 (12.4)	10 (7.3)	34 (21.9)	30 (21.9)	43 (31.4)

33	**The people around me tell me that I use my smartphone too much.**	34 (24.8)	38 (27.7)	26 (19.0)	25 (18.2)	12 (8.8)	2 (1.5)

4.6 The Prevalence of Migraine

Table 4.5 : The prevalence of migraine among medical students

Migraine	Frequency (N)	Percentage (%)
Negative	108	78.8
Positive	29	21.2

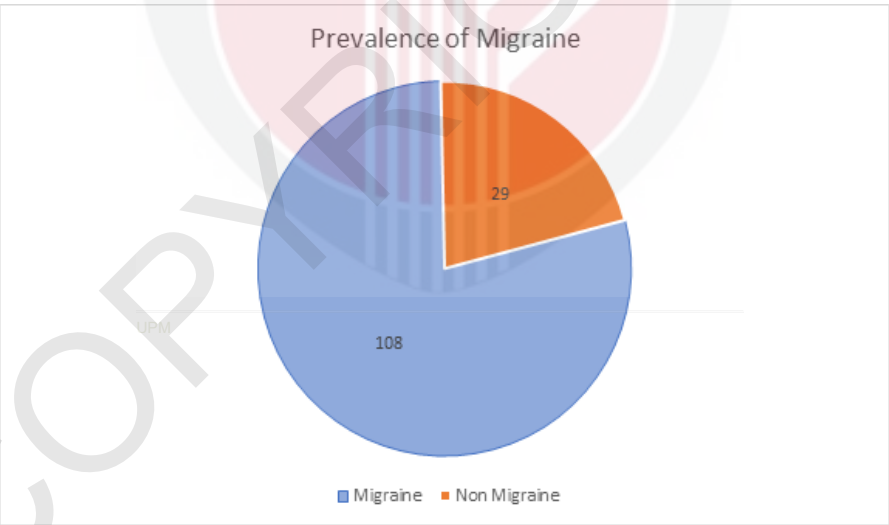

Figure 4.4: Prevalence of Migraine among Medical Students

Table 4.5 shows the prevalence of migraine among the medical students of University Putra Malaysia. The result was deduced based on the analysis of the ID-Migraine. Based on this study, the respondents were divided into two categories in which respondents who answered 'YES' for two questions or more were categorized to have migraine, meanwhile, respondents

who answered 'YES' for less than two questions were categorized as non-migraineurs. There were 29 respondents answered 'YES' for two or more questions, hence they were categorized to have migraine. The prevalence of migraine among the medical students was 21.2%.

Table 4.6.: The frequency of ID-Migraine questionnaire (N=137)

Variable	Frequency (Percentage, %)	
During the last 3 months, did you have the following with your headaches:	**Yes**	**No**
1. You felt nauseated or sick to your stomach	27 (19.7)	110 (80.3)
2. Light bothered you (a lot more than when you don't have headaches)	34 (24.8)	103 (75.2)
3. Your headaches limited your ability to work, study, or do what you needed to do for at least 1 day	40 (29.2)	97 (70.8)

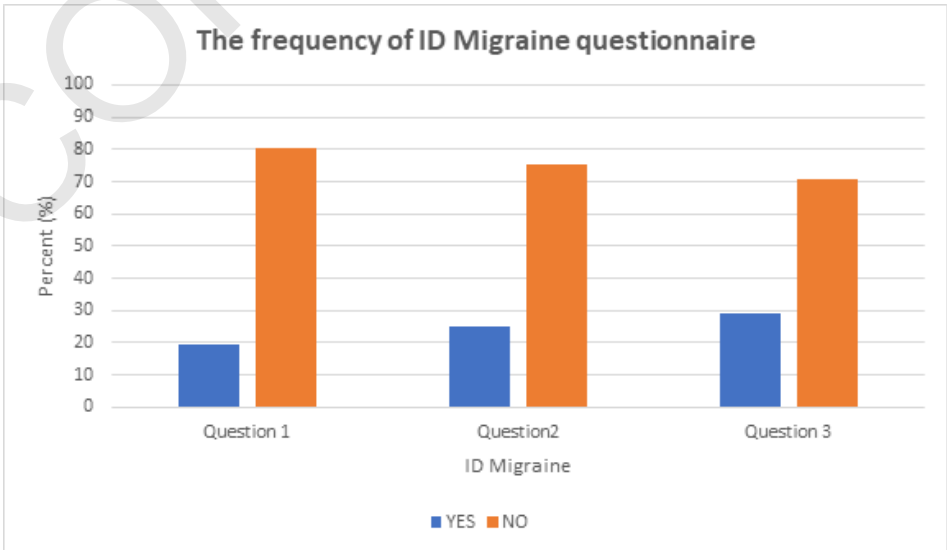

Figure 4.5: The frequency of ID-Migraine questionnaire

Based on the ID-Migraine questionnaire (Table 4.6), 19.7% respondents felt nauseated or sick to their stomach in the last three months. Approximately 24.8% respondents experienced photophobia and 29.2% of the respondents had disability to carry out daily tasks such as occupation and studying.

4.7 Severity of Migraine

Table 4.7 (a) shows the median score for MIDAS Total score and Table 4.7(c) shows median score for each item in the MIDAS questionnaire. The median score was 10.00, with range from 0-68. The mean score is 15.07. Five students scored zero. The quartiles scores were 3 for the 25th percentile (Q1), 10 for the 50th percentile (Q2), and 23.50 for the 75th percentile (Q3). Table 4.7 (b) shows the MIDAS Disability Grades, 11 students (37.9%) had Grade I disability, 4 students (13.8%) had Grade II, 6 students (20.7%) had Grade III, and 8 students (27.6%) had Grade IV.

Table 4.7(a): Descriptive Statistic of MIDAS Total Score

Variable	Median (IQR)	Range (n=29)
MIDAS Total Score	10.00 (21)	68

Table 4.7 (b) : Midas Disability Grades

MIDAS Grade	Definition	Frequency(n=29) (%)
I	Little or No Disability	11(37.9)
II	Mild Disability	4 (13.8)
III	Moderate Disability	6 (20.7)
IV	Severe Disability	8 (27.6)

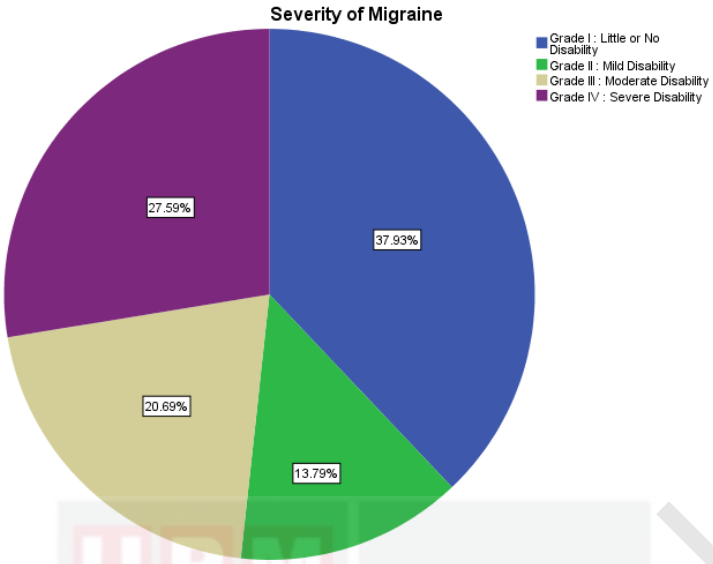

Figure 4.6: Distribution of Severity of Migraine

Table 4.7 (c): Statistics of MIDAS questionnaire

Items	**Median (IQR)**
PART 1	
1. On how many days in the last 3 months did you miss work or school because of your headaches?	0.00 (2.50)
2. How many days in the last 3 months was your productivity at work or school reduced by half or more because of your headaches? (Do not include days you counted in question 1 where you missed work or school.)	2.00 (7.00)
3. On how many days in the last 3 months did you not do household work (such as housework, home repairs and maintenance, shopping, caring for children and relatives) because of your headaches?	1.00 (5.00)
4. How many days in the last 3 months was your productivity in household work reduced by half of more because of your headaches? (Do not include days you counted in question 3 where you did not do household work.)	3.00 (7.50)
5. On how many days in the last 3 months did you miss family, social or leisure activities because of your headaches?	0.00 (3.00)
PART 2	
A. On how many days in the last 3 months did you have a headache? (If a headache lasted more than 1 day, count each day.)	3.00 (5.00)
B. On a scale of 0 - 10, on average how painful were these headaches? (where 0=no pain at all, and 10=pain as bad as it can be.)	5.00 (3.00)

4.8 The Descriptive Statistics on the Frequency of Clinical Questions On Migraine

Table 4.8: Data on clinical questions of Migraine

Variables	Median (IQR)	Frequency (Percentage, %) (N=29)
1. Warning signs such as visual problem weakness or sensory problems in one side of the body within 1 hour before the headache attack		
Yes		11(37.9)
No		18 (62.1)
2. Medicine taken		
Do not take any medication		10 (34.5)
Panadol/Paracetamol		15 (51.7)
Ponstan		2 (6.9)
Imigran/Sumatriptan		1 (3.4)
Others		1 (3.4)
3. Days per month medications taken for acute headache	2.0(3.2)	
4. The current headache is related to any recent event:		
Stress and smoke from cigarette		1 (3.4)
Prolonged listening to 'aura positive mediation while sleeping		1 (3.4)
Prolonged screen time		2 (6.8)
Stress		4 (13.7)
Stress, prolonged screen time		1 (3.4)
Stress, prolonged screen time, inadequate sleep		1 (3.4)
Not sure whether or not is due to any event		1 (3.4)
Can't remember		1 (3.4)
None		17 (58.6)

5. Severity of disease

Do not have any disease	5(17.2)
Not at all severe	11(37.9)
A little severe	7(24.1)
Somewhat severe	1(3.4)
Moderately severe	3(10.3)
Quite severe	1(3.4)
Very severe	1(3.4)

The clinical questionnaire of migraine consists of five questions. Only the respondents who categorized to have migraine based on the ID-Migraine questionnaire answered this questionnaire. Out of the 29 respondents who have migraine, 37.9% of them experienced aura such as visual problems, weakness or sensory problems in one side of the body within 1 hour before the headache attack.

Approximately, 34.5% of participants did not take any medications to treat the headaches. Majority of the respondents with migraine (51.7%) took paracetamol as a painkiller to relieve the condition. 6.9% of them took ponstan and 3.4% of them had Imigran / Sumatriptan or other drugs for their headaches. None of them took Synflex / Naproxen, Cafergot or Topamax to reduce the headache.

Out of the 29 respondents, the median score of days per month medication taken for acute headache was 2. It is estimated that the majority of the respondents took medication for a few days only. Among the participants, 37.9% of them considered that their headache is not severe at all while 24.1% of them believed that their disease is a little severe. About 10.3% of them believed that their disease is moderately severe. Approximately 3.4% of them believed

that their disease is either somewhat severe, quite severe or very severe respectively. Only 17.2% of them answered that they did not have any diseases.

Based on the questionnaire, the majority of the respondents (58.6%) answered that their current headache was not related to any events followed by 13.7% of them agreed that the current headache was related to stress. Prolonged screen time was related to current headache among 6.8% of the respondents. Current headache related to categories of prolonged listening to 'aura positive meditation' while sleeping, stress and smoke from cigarette, stress and prolonged screen time, stress with prolonged screen time and inadequate sleep, not sure and can't remember recorded 3.4% of participants respectively for each of the categories mentioned.

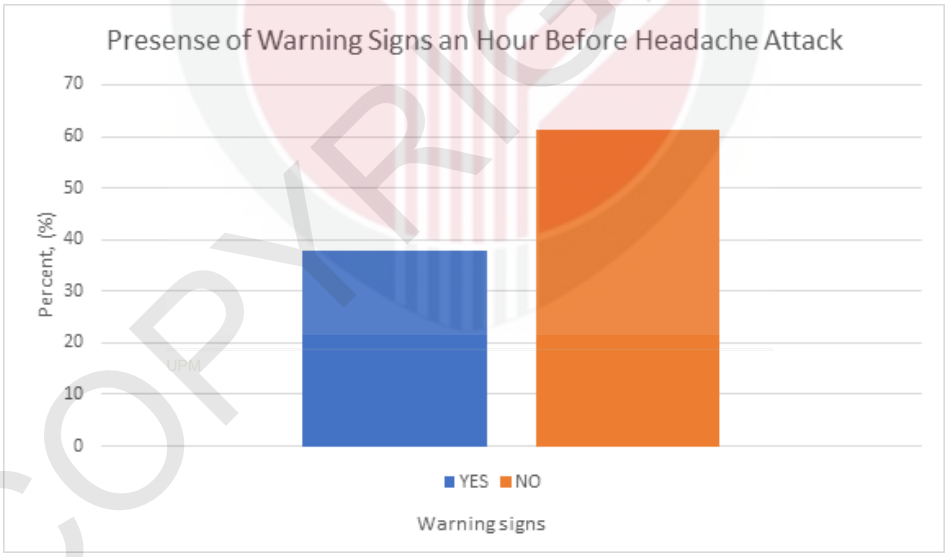

Figure 4.7(a): The Presence of Aura before Headache

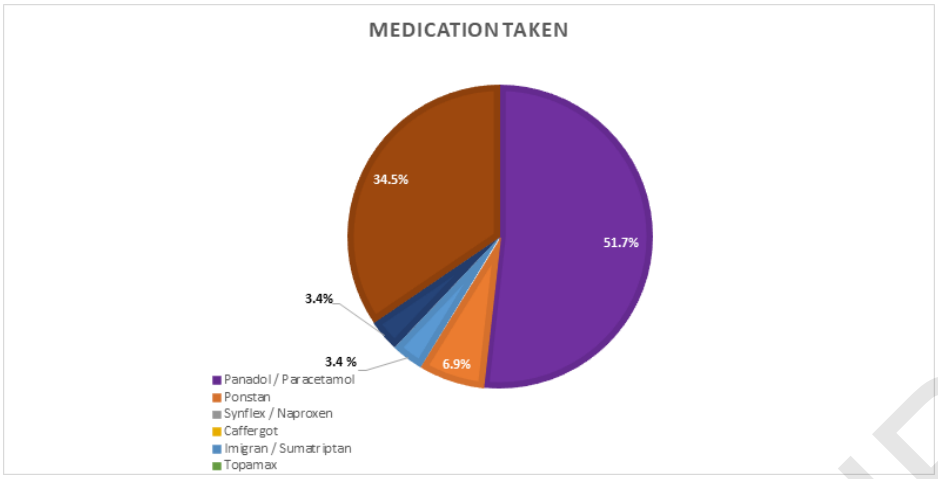

Figure 4.7 (b): The Distribution of Medication Taken

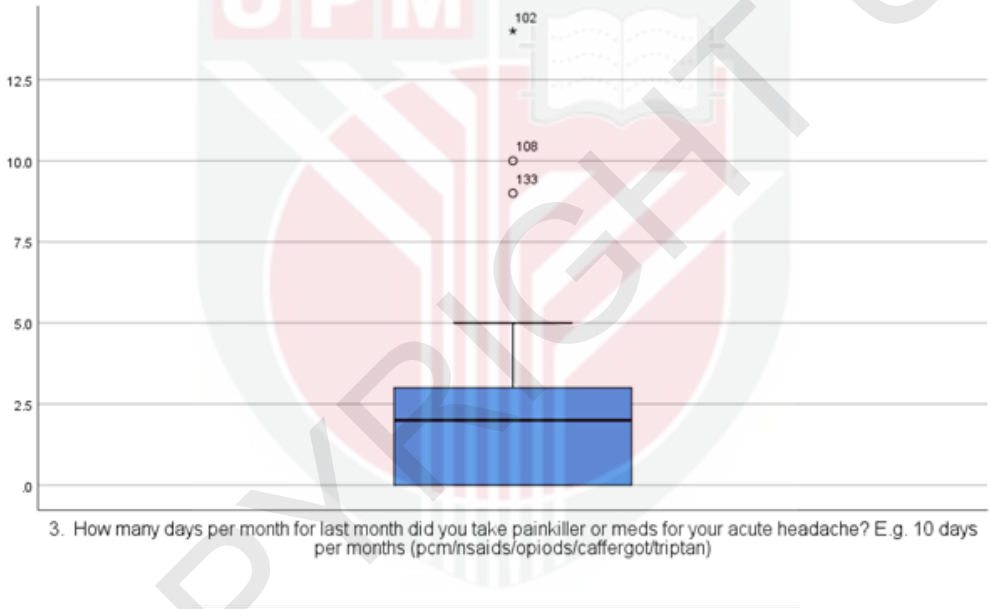

Figure 4.7 (c): The Median Score of Days Medicine Taken for Acute Headache

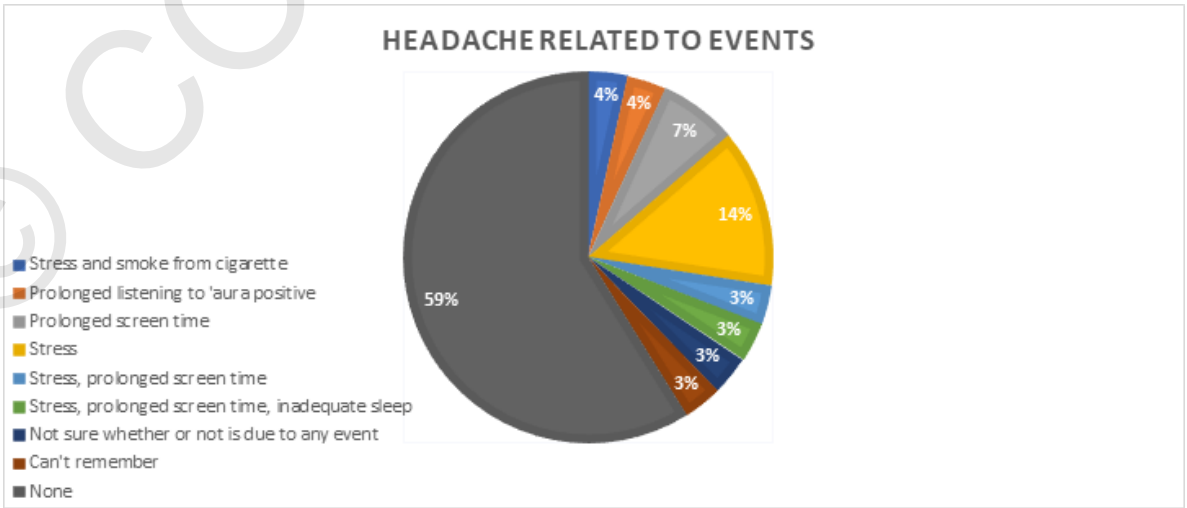

Figure 4.7 (d): The Headache related to Events

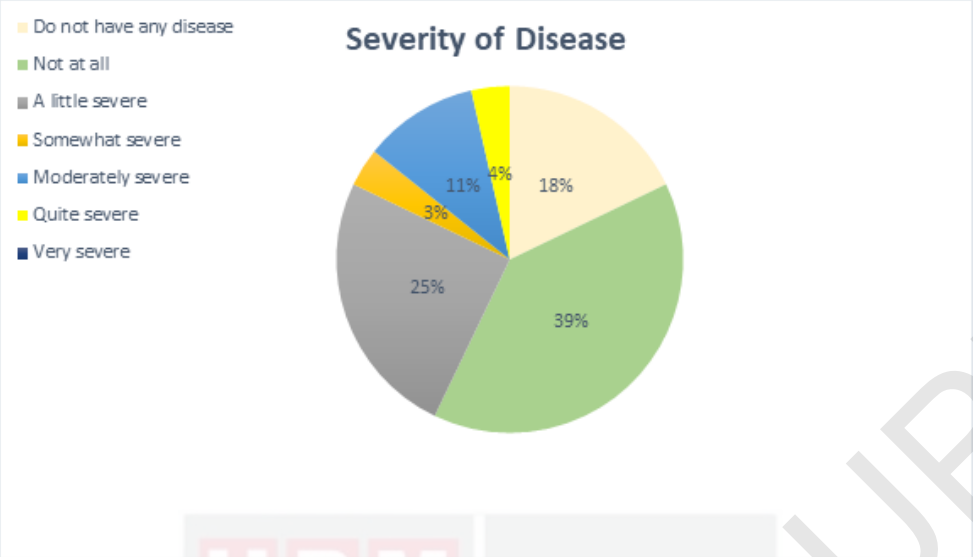

Figure 4.7 (e): The Severity of the headache

4.9 The Association Between Sociodemographic Factors and Migraine

4.9.1 Gender

Table 4.9 shows the association between gender and migraine in medical students. The hypothesis of the association of gender and migraine in medical students was analysed using the Pearson Chi-Square test. This test showed that the p-value is 0.784 (p-value >0.05). This means the value was not statistically significant. Thus, the null hypothesis was not rejected. There was no significant association between gender and migraine in medical students.

Table 4.9: Association between Gender and Migraine among Medical Students

		Frequency (% within migraine)		Total	p-value	X^2	df
		Migraine					
		No	**Yes**				
Gender	**Male**	38 (35.2)	11 (37.9)	49(35.8)	0.784	0.075	1
	Female	70 (64.8)	18 (62.1)	88 (64.2)			

Total		108 (100)	29 (100)	137 (100.0%)			

4.9.2 Year of Study

Table 4.10 shows the association between year of study and migraine in medical students. The hypothesis of the association of year of study and migraine in medical students was analyzed using the Pearson Chi-Square test. This test showed that the p-value is 0.418 (p-value >0.05). This means the value was not statistically significant. Thus, the null hypothesis was not rejected. There was no significant association between year of study and migraine in medical students.

Table 4.10: Association between Year of Study and Migraine among Medical Students

		Frequency	(% within migraine)	Total	p-value	X^2	df
		Migraine					
		No	**Yes**				
Year of Study	**1**	31 (28.7)	9 (31.0)	40 (29.2)	0.418	3.915	4
	2	21 (19.4)	6 (20.7)	27 (19.7)			
	3	17 (15.7)	3 (10.3)	20 (14.6)			
	4	20 (18.5)	9 (31.0)	29 (21.2)			

5	19 (17.6)	2 (6.9)	21 (15.3)	
Total	108 (100.00)	29 (100.00)	137 (100.00)	

4.9.3 Family Income

Table 4.11 shows the association between family income and migraine in medical students. The hypothesis of the association of family income and migraine in medical students was analyzed using the Pearson Chi-Square test. This test showed that the p-value is 0.342 (p-value >0.05). This means the value was not statistically significant. Thus, the null hypothesis was not rejected. There was no significant association between family income and migraine in medical students.

Table 4.11: Association between Family Income and Migraine among Medical Students

		Frequency (% within migraine)		Total	p-value	X^2	df
		Migraine					
		No	**Yes**				
Family Income (RM)	**<3000**	25(23.1)	10 (34.5)	35 (20.9)	0.342	2.146	2
	3000-6275	30(27.8)	5(17.2)	35 (21.1)			
	>6275	53(49.1)	14(48.3)	67 (48.9)			
Total		108(100.0)	29(100.00)	137(100.00)			

4.10 The Association Between Smartphone Addiction and Migraine

Table 4.12 shows the association of smartphone addiction and migraine in medical students. The hypothesis of the association of smartphone addiction and migraine in medical students was analysed using Pearson Chi Square Test. This test showed that the p-value is 0.137 (p-value >0.05). This means the value was not statistically significant. Thus, null hypothesis not rejected. There was no significant association between smartphone addiction and migraine in medical students.

Table 4.12 Association of Smartphone Addiction and Migraine among medical students

		Frequency (% within migraine)		Total	p-value	X^2	df
		Migraine					
		No	**Yes**				
Smartphone Addiction	**No**	54 (50.0)	10 (34.5)	64 (46.7)	0.137	2.211	1
	Yes	54 (50.0)	19 (65.5)	73 (53.3)			
Total		108 (100.00)	29 (100.00)	137 (100.00)			

4.11 The Association Between Smartphone Addiction and Severity of Migraine among the Migraineurs

Table 4.13 shows the association between smartphone addiction of migraineurs and severity on migraine among medical students based on the MIDAS grade. The hypothesis of the association of smartphone addiction between migraineurs and migraine severity among medical students was analysed using the Pearson Chi-Square test. This test showed that the p-value is 0.302 (p-value >0.05). This means the value was not statistically significant. Thus, the

null hypothesis was not rejected. There was no significant association between smartphone addiction between migraineurs and migraine severity among medical students. Migraineurs with smartphone addiction are not having worse migraines than migraineurs without smartphone addiction.

Table 4.13 Association between Smartphone Addiction of migraineurs and severity of migraine among medical students

		Frequency (% within Smartphone addiction)				Total	p-value	X^2	df
		Severity Of Migraine							
		Grade 1	**Grade 2**	**Grade 3**	**Grade 4**				
Smartphone Addiction	**No**	5 (50)	0	3 (30)	2 (20)	10 (100)	0.302	3.649	3
	Yes	6 (31.6)	4 (21.1)	3 (15.8)	6 (31.6)	19 (100)			
Total		11 (37.9)	4 (13.8)	6 (20.7)	8 (27.6)	29 (100)			

CHAPTER 5
DISCUSSION

5.1 Prevalence of Smartphone Addiction

In this study, the smartphone addiction among the medical students was measured by using the Smartphone Addiction Scale (SAS). The SAS questionnaire is reliable with the value of Cronbach's Alpha of 0.960. Based on the data analysis, the prevalence of smartphone addiction among medical students of University Putra Malaysia was 53.3%. However, the findings of the prevalence of smartphone addiction in our research is different compared to other studies. For instance, a study conducted among university students in Saudi Arabia showed that the prevalence of smartphone addiction was 19.1% when used the SAS. This prevalence rate is lower compared to our value because they categorized smartphone addiction as low if total score of a participant was between 33 and 87, intermediate if it was between 88 and 142 and high if score was between 143 and 198 (Palsule, Shetty, Gupta, Kale, & Shah, 2019). Meanwhile, the prevalence of our study was lower compared to a study conducted among the undergraduate students in University Malaysia Sabah, which showed that the prevalence of smartphone addiction was 61.2% based on SAS (Goh & Swe, 2019). The differences in the prevalence could be due to various reasons. Overall, the high prevalence of smartphone addiction among medical students in UPM is needed to give attention.

5.2 Prevalence of Migraine

Based on this research study, it was deduced that the prevalence of migraine among medical students of University Putra Malaysia was 21.2%. ID-Migraine questionnaire was used to measure the prevalence of the migraine among the medical students. However, 29.3% participants had their migraine affect them to accomplish their daily duties. Although this value

is higher, not all the 29.3% students with headaches were considered to have migraines. The finding of our study is similar to the study conducted among the university students in Southern Turkey. Migraine type headache was reported in 21.9% of the students based on the ID-Migraine questionnaire (Bicakci, S et.al, 2008). However, another study conducted among the medical students at the Kuwait University in 2014, had a prevalence rate of 27.9% based on ID-Migraine (Al-Ashel, et.al, 2014). This prevalence rate is relatively higher compared to our study. The prevalence of our study was higher compared to other international studies such as 7.14% in Iran (Shahrakai M.R, et.al.. 2011) and 13.1% in South East Nigeria (Ezeala-Adikai B.A, Ekenze O.S, Onwuekwe I.O, 2013).

The changes in the prevalence can be due to certain factors. The proportion of female respondents was higher in our research which may increase the frequency of migraine among our sample. Based on our research, 64.2% of total respondents were female. Based on the ID-Migraine, female respondents had higher migraine frequency compared to male. 62.1% of the total migraineurs were female. This data is similar to another research conducted among medical students in Isfahan, Iran where 63.8% of total migraineurs were female (Ghorbani A, et.al.). Another study conducted in Jazan University which had a 50.4% response rate by females found out that prevalence of migraine in females (61.5%) is higher than males (38.5%) (Akour A, Shabi W, Ageeli A.). So, a higher proportion of female respondents could affect the prevalence of the study.

Furthermore, the research methodology and the instrument (self-administered questionnaire) used in this study can be different compared to other researches (Balaban et al., 2012). However, ID Migraine self-administered questionnaire used in our research is a valid and reliable instrument with a sensitivity of 0.81 (95% CI, 0.77 to 0.85), a specificity of 0.75 (95% CI, 0.64 to 0.84) (Lipton RB, Dodick D, Sadovsky R, et al. 2003). In certain cases, the level of

understanding towards the questionnaire could lead to a varying level of prevalence among the participants. Overall, the high prevalence of migraine among the medical students in UPM should not be neglected because the prevalence rate is very high compared to other international studies among the university students. Females should be more vigilant towards the migraine symptoms as the migraine is more prevalent among them compared to male.

5.3 Severity of Migraine

The MIDAS questionnaire can provide a realistic tool to help suggest treatment recommendations for migraine patients and encourage communication between doctors and patients to allow a better understanding of migraine 's effect (Demirkirkan, Ellidokuz and Boluk, 2006). In a study carried out in Turkey about the headache characteristics of senior medical students by Bicakci et al. (2007), results showed MIDAS scoring was as the following: 41.9% for grade I, 19.3% for grade II, 29.1% for grade III, and 9.7% for grade IV. Meanwhile in our study, among the medical students with migraine, 37.9% had Grade I disability, 13.8% had Grade II, 20.7% had Grade III, and 27.6% had Grade IV. Our findings were similar with the findings of the Turkey senior medical students' study findings with the largest proportion of students being in Grade 1. The number of students participating in the MIDAS questionnaire were almost the same in both studies with the Turkey medical students of 31, and in our study there were 29 students.

In our study, the medical students had experienced a median score of 3 attacks in the past 3 months and pain intensity median score of 5. Bicakci et al. (2007), found the average number of days with headache was 6.2 in 3 months. With the results of only 3 attacks in the past 3 months, we indicate that the occurrence of migraine episodes among medical students in UPM was not that frequent.

5.4 Clinical Characteristics of Migraine

In this research, the characteristics of the Migraine was assessed through the five clinical questions which are the presence of aura such as visual problem, weakness or sensory problems in one side of the body within 1 hour before the headache attack, medication taken to control the headache, days medication taken, headache related to any events and the severity of migraine based on the respondents opinion. 29 respondents who were migraineurs based on the ID-Migraine questionnaire answered this questionnaire of characteristics of migraine. 37.9% respondents were having neurological problems (aura) at one side of their body. But we did not collect any data on the characteristics of aura presented. Migraine without aura was the most common type of migraine presented in our study. Based on a study conducted by Russell, M.B et.al in 1995 in 2006, 1/3 of migraine patients experience aura (Hansen, J. M., & Charles, A., 2019). Another study conducted in 1999 states that 17.9% of total migraineurs had migraine with aura (Lenore JL, Gisela MT, Michael DF). The prevalence of aura among the migraines in our study is slightly higher compared to it. We did not collect further information on the type of the aura among our respondents. Approximately 99% of the patients with migraine with aura suffered with visual problems (Kirchmann M, 2006). So, we assume that most of our respondents might have experienced migraine with aura because it is very common.

Based on this questionnaire, 15 respondents out of 29 were taking paracetamol (acetaminophen) to relieve the headache. Use of paracetamol is very high because paracetamol is cheap and over the counter drug. So it is very easy to obtain paracetamol especially under the name of 'Panadol' in convenient stores. A research conducted around 2013 found out that a single dose of paracetamol 1000 mg will resolve headache pain completely for moderate or severe migraine among 19% of subjects. (Derry S, Moore RA., 2013). In our study, approximately ⅗ of the respondents who consumed paracetamol had MDAS score of Grade 1

and 2. Thus, they had mild headaches and needed paracetamol alone to control the headache. Then, 34.5% respondents did not take any medication. This is possible as 37.9% of respondents had MIDAS Grade 1, so they might not have a severe headache. Around 10.3% respondents took either Imigran / Sumatriptan or Ponstan. These 3 respondents had a Midas score of mild (1), moderate (1) and severe (1) disability. So, only ⅓ participants taking this medication have a higher MIDAS grade. These drugs are expensive. So, it can be a reason for less respondents to take this medication.

The median score of days medication taken for acute headache in a month was 2 suggesting that medication is least necessary among the studied group to treat their migraine. According to ICHD-3 by the International Headache Society, overuse of medication may cause Medication-overuse headache (MOH). This condition is caused by the frequent overuse of acute headache medication for at least10 days or more in a month for more than 3 months. Usually this condition is resolved when the overuse of medication is stopped. In our study, only 2 out of 29 respondents had medication for 10 days or more. This suggests that they might be suffering from medication-overuse headaches. In our study, 17 respondents out of 29 (58.6%) stated that their headache is not related to any recent events. Around 20.3% of them considered that their migraine was related to stress. Based on a research in 2013, the migraine has a significant correlation with stress. (Yavuz, B.G., Aydinlar, E.I., Dikmen, P.P. *et al).* This finding supports our data on the effect of stress as a trigger of migraine. Based on the last questions of the questionnaire 24.1% had an opinion that their migraine is a little severe. Only 6.8% respondents considered their migraine to be quite/very severe. When compared with the severity of migraine based on MIDAS scale, 37.9% of them had MIDAS grade 1. The value is exactly the same as 37.9% thinks that the migraine is not severe at all.

5.5 Association between Sociodemographic and Migraine among medical students

5.5.1 Gender

Most previous studies have shown a higher prevalence in females than male students. One of the explanations for this may be the effect of oestrogen, which causes menstrual migraine attacks to manifest without an aura and has increased duration, physical impairment, and resistance to care (Gu and Xie, 2018). However, there was no significant association between male and female students in some studies. Gender (χ^2=0.12, P=0.73) did not significantly influence migraine prevalence (Wang et al., 2015). Although the overall prevalence of migraine in our study is higher in females, the association between gender and migraine is not statistically significant with the p-value of 0.784. This is likely because of the higher number of female participants but the prevalence of migraine among each male and female gender shows no significant difference of 22.4% and 20.5% respectively. Similar percentages of migraine faced by both the gender may be due to the same academic stress and pressure faced by the medical students. Other reasons for migraine among females may be explained by hormonal changes and migraine among males can be explained by physical exertion such as intense exercises. Research has shown a link between migraine and an increased risk of heart disease in men. In this case, migraine can be caused by hypersensitive blood vessels that regularly contract and dilate (National Headache Foundation,2020).

5.5.2 Year of Study

In our study, the association between year of study and migraine had shown a p-value of 0.418 (p-value >0.05). This means that the value was not statistically significant. Thus, there is no significant association between year of study and migraine in medical students. However, the prevalence of migraine is the highest in first year medical students and Year 4 medical students with both 31%. In Soochow University, a study done by Gu and Xie (2018), showed a similar

presentation of higher migraine prevalence among first- and second-year students in both undergraduate and graduate levels. Gu and Xie added that this phenomenon can be explained by adaptation and learning stresses in a new setting among junior students at the Soochow University. For our study, the reason for higher migraine prevalence among first year medical students may also be explained by the same pressure faced by medical students of Soochow University.

5.5.3 Family Income

According to the results from a study by Stewart, Roy and Lipton (2013), migraine prevalence increased as household income decreased for females ($\chi 2$, $p < 0.01$) and males ($\chi 2$, $p<0.01$). Another study among the Spanish adults by Fernández-de-las-Peñas et al. (2010), also found that migraine was more common in those of lower income (AOR 1.19, 95% CI 1.01-1.41) and who sleep <8 h/day (AOR 1.18, 95% CI 1.04-1.33). In our study, among 29 students who were having migraine, 34.5% from B40 family and 17.2% from M40 family and the majority, 48.3% of them were from T20 family. As a result, there was no statistically significant association between family income and migraine among medical students. We suggest that this may be because our study population are medical students and they are not working yet. So, when it comes to family income, they may not be as stressful as the working adults. Moreover, in Malaysia, there are educational loans for students studying in Higher Education Institutions locally, called PTPTN Education Loan Scheme. These loans will enable students to finance a full or partial tuition fee and living cost during the study period, thus lessening the burden of financial problems faced by students. There are also various scholarships available for medical students such as JPA scholarship and state's scholarship in helping students who had financial difficulties. Therefore, family income does not show a significant impact on migraine among medical students.

5.6 Association between Smartphone Addiction and Migraine among medical students

The association between smartphone addiction and migraine had shown a p-value of 0.137 (p-value >0.05) which is no significant association between smartphone addiction and migraine in medical students. However, among the students with migraine in our study, a bigger proportion, which is 65.5% of them were shown to have smartphone addiction while 34.5% not having smartphone addiction. Other than that, we found out 8 out of 11 male migraineurs had smartphone addiction. Similarly, 11 out of 18 female migraineurs had smartphone addiction. Following the trend, we can deduce that smartphone addiction may be one of the causes of migraine although we didn't get a significant result. Underpowered of our study may be the reason to not result in statistically significant findings. Therefore, a bigger study population of research may be replicated in the future to find out whether there is an association between smartphone addiction and migraine. Comparing to a study done by Cerutti et al. (2016), on the potential impact of internet and mobile use on headache, there was no significant relationship was found between students with and without headache with respect to the abuse of internet and mobile phone categories (headache was, respectively, the 26% in no abusers, the 30% in internet abusers, the 29% in mobile abusers, and the 29% in internet and mobile abusers, P = .86)

5.7 Association between Smartphone Addiction and Severity of Migraine among the Migraineurs

In this research, the association between smartphone addiction (based on SAS) on severity of migraine (based on the MIDAS Grade) was analysed and a p-value of 0.302 was obtained based on the analysis. The smartphone addiction among the migraineurs was 65.5%. Although a high percentage of participants with migraine are smartphone addicts, the association between smartphone addiction and severity of migraine is not significant. This is because 51.7% of

migraineurs had a MIDAS Grade of 1 or 2. It clearly shows that more than half of them do not have a higher MIDAS Grade, so the smartphone addiction does not associate significantly with the severity of migraine. We suggest that a bigger sample size could yield better results as a sample size of 29 students with migraine is very small to be analysed in our study. Based on the p value, there is no significant association between smartphone addiction and severity of migraine among the migraineurs in our research. When compared with other researches, a study conducted in 2019 concluded that there was also no significant association between smartphone addiction and severity of migraine among the migraineurs with the p value of 0.993 among the 123 research subjects. (Yasemin P. Demir, Mehmet M. Sümer. Another study found that the characteristics of headache were the same in both the groups (smartphone users and non-smartphone users), except for higher occurrence of aura among the high smartphone users and the smartphone use group had a poor response to medication. (Uttarwar et al., 2020). The study found that there was no significant association between smartphone use and occurrence of headache. So, our results are similar compared to the studies. The exact reason behind the result was unknown but it was assumed that certain modifications such as a blue light filter while using a smartphone can reduce the headache rate. A study conducted in 2016 among young adults concluded that prolonged screen time exposure and migraine have a significant association (Montagni I., et.al.). Besides, a study which includes sixty-nine patients diagnosed with migraine found out that the migraine intensity is exacerbated by blue light from electronic devices (Noseda R). So, smartphone use may exacerbate the intensity of the migraine among the migraineurs but it solely does not cause the migraine.

CHAPTER 6

CONCLUSION

6.1 Conclusion

Most of the respondents are female, from Year 1 medical students and have a family income of >RM 6275. The prevalence of smartphone addiction among medical students is 53.3% while the prevalence of migraine among medical students is 21.2%.

The severity of migraine among the medical students was little or no disability (Grade 1). There was no significant association between the sociodemographic factors (gender, year of study and family income) and migraine. Although there was no significant association between smartphone addiction and migraine among the medical students, there is a trend of more migraineurs who are having smartphone addiction in both genders. So, we believe that in a study with larger sample size, it may result in a significant finding.

6.2 Strength of Study

The strength of our study is our research is the first research that studied the relationship between smartphone addiction and migraine among the medical students in a tertiary university in Malaysia. There was no previous study about the association of smartphone addiction and migraine nationwide. We believe that our study would be a starting point for more similar research to be made in future. This study also gives awareness to the medical students on both smartphone addiction and migraine issues. Through this study, they may realise the importance of proper smartphone usage to avoid addiction and a reminder to seek medical attention if they are suspected to have migraine. This research topic can also be conducted among different courses students or different age groups to study about the relationship of smartphone addiction and migraine among them and how migraine affects their lives. Furthermore, this study would

be of great help for future researchers to compare their data and results to create findings on the relationship between smartphone addiction and migraine in Malaysia and also worldwide.

6.3 Limitations of Study

The results obtained were affected mainly by a number of methodological limitations. To begin with, given the cross-sectional nature of our current study, cross sectional study may not provide definite information about cause-and-effect relationships. Therefore, the temporal sequence of exposure and effect may be difficult or impossible to determine. Researchers can conduct a cohort study in the future to establish links between smartphone addiction and migraine. For the limitation during data collection, we distributed the questionnaire to the participants through WhatsApp only due to Covid-19 Pandemic lockdown nationwide. We did not obtain a 100% response rate because some participants were busy with final exams and some did not read the messages we sent through WhatsApp. Although distributing questionnaires through WhatsApp is not a good option but it was the best option to come up during lockdown to maintain social distance. Other than that, the classification of both smartphone addiction using the SAS questionnaire and migraine using the ID-Migraine questionnaire solely relied on a self-report screening tool. As a result, response bias (social desirability bias) could not be completely avoided. To resolve this in future studies, it is suggested to implement the Social Desirability Bias Scale, which is the Marlowe-Crowne Social Desirability Scale.

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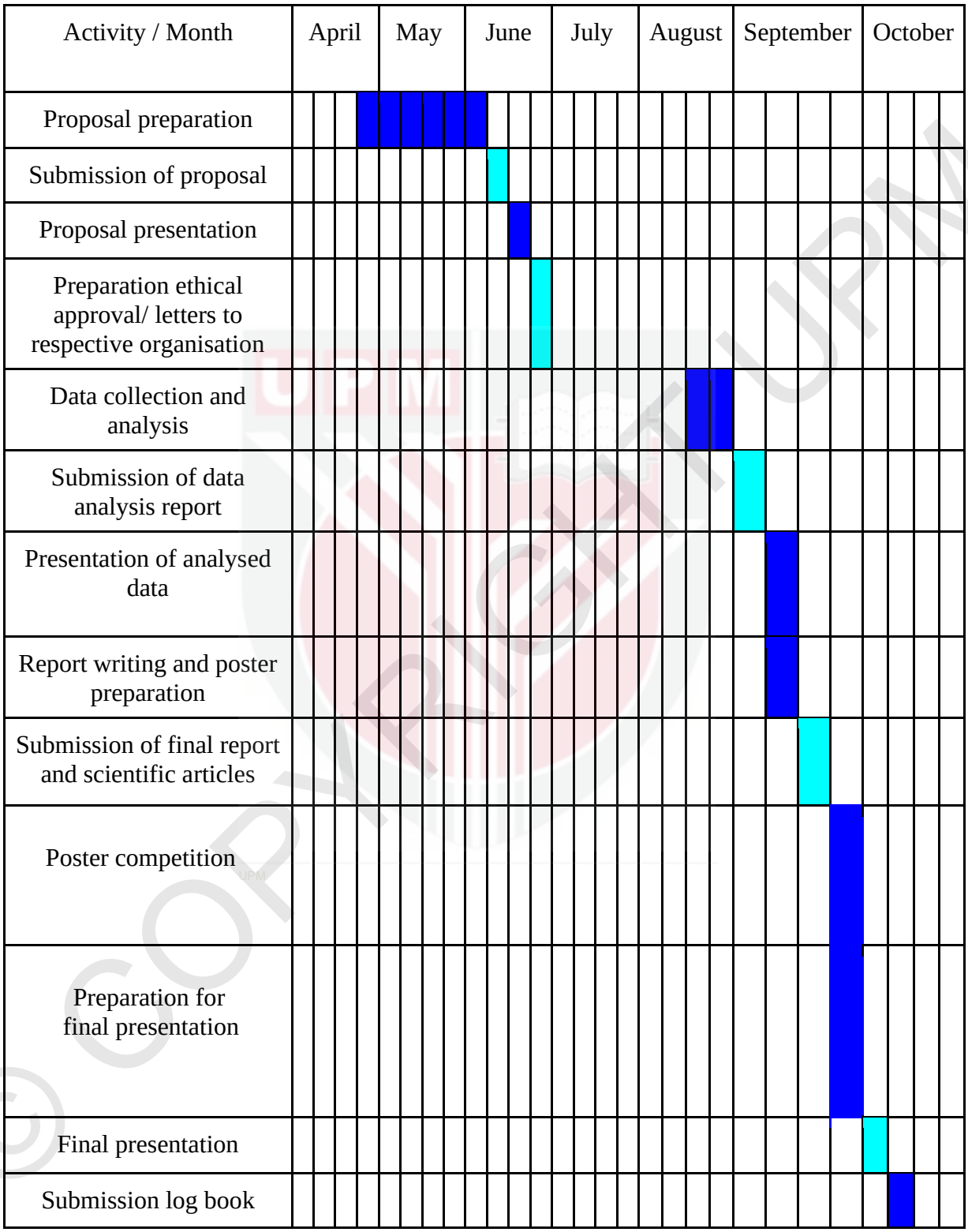
WORK PLAN



ETHICAL FORM

JAWATANKUASA ETIKA UNIVERSITY UNTUK PENYELIDIKAN MELIBATKAN MANUSIA (JKEUPM)

UNIVERSITY PUTRA MALAYSIA, 43400 UPM SERDANG, SELANGOR, MALAYSIA

FORM 2.4: RESPONDENT'S INFORMATION SHEET AND INFORMED CONSENT FORM

Please read the following information carefully and do not hesitate to discuss any questions you may have with the researcher.

1. STUDY TITLE:

A Cross-sectional Study on the relationship between Smartphone Addiction and Sociodemographic factors on Migraine among medical students in University Putra Malaysia (UPM), 2020.

2. INTRODUCTION:

In the Faculty of Medicine and Health Sciences, there are about 500 students taking an undergraduate medical degree (MD) programme. Upon observation, it is found that medical students suffer from migraine quite regularly. Therefore, this research is conducted to determine the prevalence of migraine among medical students of UPM. We also found that smartphone addiction has been a big issue faced by students nowadays. Therefore, through this research, we hope to study the relationship between smartphone addiction and migraine. If proven these two variables are having an association, we hope students will give more attention

in minimizing the usage of smartphones which may be a cause of migraine in students. This study also aids to find out if any students are facing severe migraine to seek medical treatment to prevent it from worsening. The study will be conducted from 1 June 2020 until 9 October 2020. The data collection will be distributed and collected from 17 August 2020 until 24 August 2020 and we estimate the number of participants will be around 150.

3.WHAT WILL YOU HAVE TO DO?

If you decide to take part in this research, you need to fill in your personal information. Besides you also need to fill in the ID-Migraine, Smartphone Addiction Scale (SAS), and Migraine Disability Assessment (MIDAS) questionnaire. Please note that participation is voluntary, and participants may withdraw anytime without penalty or loss of benefit. Other than that, participants will be paid RM5 for their participation in this study.

4.WHO SHOULD NOT PARTICIPATE IN THE STUDY?

You should not participate if you are a medical student from UPM which does not have a smartphone.

5. WHAT WILL BE THE BENEFITS OF THE STUDY:

(a)TO YOU AS THE SUBJECT?

You will be informed if you have any condition of Migraine or Smartphone Addiction. Once the research is done, you may consider having an appointment with a doctor so that appropriate treatment regimens can be taken before it affects the psychological component of your life if you are prone to having one of these disorders.

(b) TO THE INVESTIGATOR?

The investigator can determine if there is truly an association between Smartphone Addiction and Sociodemographic on migraine. If proven, measures have to be taken because smartphone addiction and migraine can affect the student's academic and social aspects which eventually can lead to a decreased quality of life.

6. WHAT ARE THE POSSIBLE RISKS?

There is no significant risk to our respondents. However, the respondent will be advised to see a psychiatrist if he/she is found to show smartphone addiction to treat their smartphone addiction.

7.WILL THE INFORMATION THAT YOU PROVIDE AND YOUR IDENTITY REMAIN CONFIDENTIAL?

The research investigators will collect personal information about you as a part of the study but your identity (name, student ID) will be kept confidential. The data obtained from this study are allowed to be shared during discussions or any other related sessions within our research team. However, apart from our team, any other information concerning you will be kept in strict confidentiality.

8. WHO SHOULD YOU CONTACT IF YOU HAVE ADDITIONAL QUESTIONS DURING THE COURSE OF THE RESEARCH?

1. AP DR. Wan Aliaa binti Wan Sulaiman
Department of Medicine,
Faculty of Medicine and Health Sciences, UPM

2. AP DR. Hayati binti Kadir @Shahar
Department of Community Health,
Faculty of Medicine and Health Sciences, UPM

3. On Shi Qing (017-4818928)
4. Nurul Syafiqah binti Burairah (011-10086710)
5. Vimalraj A/L Kanthasamy (016-5402474)

Please initial here if you have read and understood the contents this page_____

9. CONSENT

I …… Identity Card No. ……

address……

…….. ……..hereby voluntarily agree to take part in the research stated above *(clinical /drug trial/video recording/ focus group/interview-based/ questionnaire-based).

I have been informed about the nature of the research in terms of methodology, possible adverse effects and complications (as written in the Respondent's Information Sheet). I understand that I have the right to withdraw from this research at any time without giving any

reason whatsoever. I also understand that this study is confidential and all information provided with regard to my identity will remain private and confidential.

I* wish / do not wish to know the results related to my participation in the research

I agree/do not agree that the images/photos/video recordings/voice recordings related to me be used in any form of publication or presentation (if applicable)

* delete where necessary

Signature: ……..…… Signature: ……..…….

(Respondent) (Witness)

Date: …….. Date: .....

Name :……. Name: ……

I/C No.: ……..

I confirm that I have explained to the respondent the nature and purpose of the above-mentioned research.

Date ……..…… Signature ……..……

(Researcher)

QUESTIONNAIRE

TITLE: A cross-sectional study on the relationship between smartphone addiction and migraine among medical students in University Putra Malaysia (UPM), 2020.

Section A: Socio-demographic factors

This section contains 3 questions that relate to your personal information. Please select your answer in the space provided. Only ONE answer can be selected for every question.

1. What is your gender?
    - Female
    - Male
2. What year are you currently in?
    - Year 1
    - Year 2
    - Year 3
    - Year 4
    - Year 5
3. What is your family income within a month?
    - B40: < RM 3000
    - M40: RM 3000 – RM 6275
    - T20: > RM 6275

Section B: Smartphone Addiction Scale

This question consists of 33 questions. Please tick on **ONLY ONE** scale that reflects the closest statement of your smartphone use characteristics.

Items		Strongly disagree	Disagree	Weakly disagree	Weakly agree	Agree	Strongly agree
1	Missing planned work due to smartphone use	1	2	3	4	5	6
2	Having a hard time concentrating in class, while doing assignments, or while working due to smartphone use	1	2	3	4	5	6
3	Experiencing lightheadedness or blurred vision due to excessive smartphone use	1	2	3	4	5	6
4	Feeling pain in the wrists or at the back of the neck while using a smartphone	1	2	3	4	5	6
5	Feeling tired and lacking adequate sleep due to excessive smartphone use	1	2	3	4	5	6
6	Feeling calm or cozy while using a smartphone	1	2	3	4	5	6
7	Feeling pleasant or excited while using a smartphone	1	2	3	4	5	6
8	Feeling confident while using a smartphone	1	2	3	4	5	6
9	Being able to get rid of stress with a smartphone	1	2	3	4	5	6

10	There is nothing more fun to do than using my smartphone.	1	2	3	4	5	6
11	My life would be empty without my smartphone.	1	2	3	4	5	6
12	Feeling most liberal while using a smartphone	1	2	3	4	5	6
13	Using a smartphone is the most fun thing to do.	1	2	3	4	5	6
14	Won't be able to stand not having a smartphone	1	2	3	4	5	6
15	Feeling impatient and fretful when I am not holding my smartphone	1	2	3	4	5	6
16	Having my smartphone in my mind even when I am not using it	1	2	3	4	5	6
17	I will never give up using my smartphone even when my daily life is already greatly affected by it.	1	2	3	4	5	6
18	Getting irritated when bothered while using my smartphone	1	2	3	4	5	6
19	Bringing my smartphone to the toilet even when I am in a hurry to get there	1	2	3	4	5	6
20	Feeling great meeting more people via smartphone use	1	2	3	4	5	6
21	Feeling that my relationships with my smartphone buddies are more intimate than my relationships with my real-life friends	1	2	3	4	5	6
22	Not being able to use my smartphone would be as painful as losing a friend.	1	2	3	4	5	6

23	Feeling that my smartphone buddies understand me better than my real-life friends	1	2	3	4	5	6
24	Constantly checking my smartphone so as not to miss conversations between other people on Twitter or Facebook	1	2	3	4	5	6
25	Checking SNS (Social Networking Service) sites like Twitter or Facebook right after waking up	1	2	3	4	5	6
26	Preferring talking with my smartphone buddies to hanging out with my real-life friends or with the other members of my family	1	2	3	4	5	6
27	Preferring searching from my smartphone to asking other people	1	2	3	4	5	6
28	My fully charged battery does not last for one whole day.	1	2	3	4	5	6
29	Using my smartphone longer than I had intended	1	2	3	4	5	6
30	Feeling the urge to use my smartphone again right after I stopped using it	1	2	3	4	5	6
31	Having tried time and again to shorten my smartphone use time, but failing all the time	1	2	3	4	5	6
32	Always thinking that I should shorten my smartphone use time	1	2	3	4	5	6
33	The people around me tell me that I use my smartphone too much.	1	2	3	4	5	6

Section C: ID Migraine

This section contains 3 questions related to your healthcare. Please select only ONE answer either YES or NO.

During the last 3 months, did you have the following with your headaches:

1. You felt nauseated or sick to your stomach
    - Yes
    - No
2. Light bothered you (a lot more than when you don't have headaches)
    - Yes
    - No
3. Your headaches limited your ability to work, study, or do what you needed to do for at least 1 day
    - Yes
    - No

Section D: Migraine Disability Assessment (MIDAS)

The MIDAS (Migraine Disability Assessment) questionnaire was put together to help you measure the impact your headaches have on your life. The information on this questionnaire is also helpful for the researcher to evaluate the severity of pain and disability caused by your headaches.

INSTRUCTIONS

Please answer the following questions about ALL of the headaches you have had over the last 3 months. Select your answer in the box next to each question. Select zero if you did not have the activity in the last 3 months.

Part 1

1. On how many days in the last 3 months did you miss work or school because of your headaches?
2. How many days in the last 3 months was your productivity at work or school reduced by half or more because of your headaches? (Do not include days you counted in question 1 where you missed work or school.)
3. On how many days in the last 3 months did you not do household work (such as housework, home repairs and maintenance, shopping, caring for children and relatives) because of your headaches?
4. How many days in the last 3 months was your productivity in household work reduced by half of more because of your headaches? (Do not include days you counted in question 3 where you did not do household work.)
5. On how many days in the last 3 months did you miss family, social or leisure activities because of your headaches?

Total score (Questions 1-5)

Part 2

A. On how many days in the last 3 months did you have a headache? (If a headache lasted more than 1 day, count each day.)

B. On a scale of 0 - 10, on average how painful were these headaches? (where 0=no pain at all, and 10= pain as bad as it can be.)

Scoring: After you have filled out this questionnaire, add the total number of days from questions 1-5 (ignore A and B).

MIDAS Grade	Definition	MIDAS Score
I	Little or No Disability	0-5
II	Mild Disability	6-10
III	Moderate Disability	11-20
IV	Severe Disability	21+

Section E: Clinical Questions on Migraine

This section contains five questions that relate to your experience facing migraine. Please select and write your answer in the space provided.

1. Within 1 hour before the headache attack, do you have any warning signs such as visual problems (e.g. seeing zigzag lights), weakness or sensory problems in one side of the body?

- Yes
- No

2. Have you been taking these medicines?

- Panadol / Paracetamol
- Ponstan
- Synflex / Naproxen
- Caffergot
- Imigran / Sumatriptan
- Topamax
- Others
- Do not take any medication

3. How many days per month for last month did you take painkillers or meds for your acute headache? E.g. 10 days per months (pcm/nsaids/opioids/caffergot/triptan)

4. Is your current headache related to any recent event? For example, stress, prolonged screen time or visual problems. If yes, provide the details and date. If no, just put a dash (-)

5. Taking into account all aspects of your disease, how severe is your disease?

- Not at all severe
- A little severe
- Somewhat severe
- Moderately severe
- Quite severe
- Very severe
- Extremely severe
- Do not have any disease