FACTORS ASSOCIATED WITH RISK OF SMARTPHONE ADDICTION AMONG UNDERGRADUATE UNIVERSITY STUDENTS IN KELANTAN

By

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ABSTRAK (BAHASA MALAYSIA)

FAKTOR BERKAITAN RISIKO KETAGIHAN TELEFON PINTAR DI KALANGAN PELAJAR PRASISWAZAH DI KELANTAN.

Latar belakang: Penggunaan telefon pintar yang berlebihan boleh membawa kepada ketagihan. Ketagihan telefon pintar menjadi kebimbangan baru dewasa ini kerana ia berpotensi membawa kesan buruk ke atas pelbagai aspek kehidupan. Tujuan kajian ini adalah untuk menilai tahap risiko ketagihan telefon pintar dan untuk mengenal pasti faktor peramal ke atas tingkah laku ketagihan telefon pintar di kalangan pelajar prasiswazah di Kelantan.

Metodologi: Kajian ini merupakan kajian keratan rentas yang dijalankan di kalangan 140 pelajar Pusat Pengajian Sains Kesihatan USM. Pelajar diambil dari lima program pengajian yang telah dipilih secara rawak melalui kaedah persampelan kelompok pelbagai peringkat. Proforma sosio-demografi dan ciri penggunaan telefon pintar, Skala Ketagihan Telefon pintar versi Bahasa Melayu (SAS-M) untuk mengukur tahap risiko mengalami ketagihan telefon pintar dan Skala Kemurungan Kebimbangan Stres 21 - versi BahasaMelayu (DASS 21) untuk mengukur tahap kemurungan, kebimbangan dan tekanan; telah diisi sendiri oleh pelajar.

Keputusan: Skor purata SAS-M adalah 111.07 ± 25.11. Majoriti pelajar menggunakan telefon pintar lebih daripada 4 jam sehari (78.6%). Masa penggunaan harian telefon pintar (13.63, 95% CI: 4.18, 23.08, p = 0.005) dan tahap tekanan (1.57, 95% CI: 0.51, 2.62, p = 0.004) didapati mempunyai hubungan positif yang signifikan, manakala program Audiologi (- 12.98, 95% CI: -24,43, -1,54, p = 0.027) dan pendapatan keluarga kurang daripada

RM1000 (-12,52, 95% CI: -21,54, -3,50, p = 0.007) mempunyai hubungan negatif yang signifikan dengan SAS-M skor.

Kesimpulan: Tahap tekanan dan masa penggunaan harian telefon pintar adalah factor peramal yang signifikan bagi risiko ketagihan telefon pintar. Penemuan ini boleh digunakan sebagai langkah pengesanan awal ketagihan telefon pintar di kalangan pelajar universiti prasiswazah, seterusnya untuk merancang program intervensi untuk mengelakkan implikasi negatif ketagihan telefon pintar.

Kata kunci: Ketagihan telefon pintar, faktor peramal, tekanan, pelajar, universiti

ABSTRACT

FACTORS ASSOCIATED WITH RISK OF SMARTPHONE ADDICTION AMONG UNDERGRADUATE UNIVERSITY STUDENTS IN KELANTAN.

Background: Excessive smartphone use could lead to addiction. Smartphone addiction has become a recent concern because of its potential to adversely impact on many aspects of life. The aim of this study is to assess the level of risk for smartphone addiction and to identify the predictors on the smartphone addictive behaviour among undergraduate university students in Kelantan.

Methods: This is a cross-sectional study conducted among 140 students of School of Health Sciences USM. Students from five study programs were randomly selected through multistage cluster sampling method. Socio-demographic and smartphone usage characteristic proforma, Smartphone Addiction Scale Malay Version (SAS-M) to measure the level of risk for developing smartphone addiction and Depression Anxiety Stress Scale 21 – Malay Version (DASS 21) to measure depression, anxiety and stress level; were self-administered by the students.

Results: The mean score of SAS was 111.07 (SD 25.11). Majority of the students used smartphone for more than four hours daily (78.6 %). Daily usage smartphone time (13.63, 95% CI: 4.18, 23.08, $p = 0.005$) and stress level (1.57, 95% CI: 0.51, 2.62, $p = 0.004$) were found to have significant positive relationship, while Audiology program (-12.98, 95% CI: -24.43, -1.54, $p = 0.027$) and family income less than RM1000 (-12.52, 95% CI: -21.54, -3.50, $p = 0.007$) have significant negative relationship with SAS-M score.

Conclusion: Stress and daily smartphone usage time are significant predictors for risk of smartphone addiction. This knowledge could help in early detection for smartphone addiction among undergraduate university students, subsequently to plan for early intervention in order to prevent further negative implications of smartphone addiction.

Keywords: *Smartphone addiction, predictors, stress, students, university*

CHAPTER 1

INTRODUCTION

The smartphone is a unique device that is different from the basic phone which used to be just a calling device. A smartphone has additional features and multiple functions, such as an internet browser, camera, music and video player, GPS navigator, alarm clock, mobile TV and many more (1). The first smartphone was released in 1999 by a Japanese firm (2) and became increasingly popular in the late 2000s as they have become an important tool in our lives due to their convenience in terms of size and mobility, social connectivity, easy accessibility to information, workplace applications, and a lot more (3).

Since 2013, smartphone ownership rates have increased globally. From a survey by Pew Research Center in 2015, the highest rates of smartphone ownership are among the developed countries (4). According to this survey, South Korea has the highest smartphone ownership rate, with 88%; followed by Australia (77%), Israel (74%), America (72%) and Spain (71%). Beyond the developing countries, smartphone ownership is reported relatively high in Malaysia (65%), Chile (65%), Turkey (59%) and also China (58%). This survey also found that millennials (people aged 18-34), those with higher education and higher income, are more likely to own a smartphone than older generations, less education and lower income, respectively. Poushter (4) also reported that smartphone ownership is relatively high in Malaysia with significant increment from 31% in 2015 to 65% in 2015. It was among the top ten in the world.

In Malaysia, the use of smartphones increased, from 14% in 2010 to 53.4% in 2014 as reported by Hand Phone Users Survey 2014 - Malaysian Communications and Multimedia Commission (5). From this report, until 2014, one in two Malaysians was a

smartphone user. Most smartphone users are the younger population and in Malaysia, majority was from the age group of 20-24 and the average age was 29.7. Since university students are mostly from this age group, they became the target group of the telecommunication companies (6). According to Hong et al. (7), the smartphone not only plays an important role in the learning process among university students, but it also increases their social communication and expands their opportunities for establishing social relationships.

There is growing concern regarding smartphones as a potential source of addiction in view of its easy access. Recently, there has been increased interest among researchers to understand the condition. This dissertation hence was planned to look into this current issue in the context of the local population and focused on the university student population as they are the majority of the smartphone user as discussed above.

This dissertation was arranged according to the new manuscript-ready format as has been aligned by the faculty. The manuscript will represent the whole body of dissertation with the title of "Factors Associated With Risk Of Smartphone Addiction Among Undergraduate University Students In Kelantan".

CHAPTER 2

LITERATURE REVIEW

2.1   Smartphone Addiction

Addiction is a complex condition that is manifested by continuous compulsive substance use despite harmful consequence (8). The two major categories of addiction involve either substance addiction or behavioural addiction.

Behaviour addictions, are generally difficult to define because they are related not only to physical, but also to social and psychological factors (9). The core features of behavioural addiction include the following: sustained engagement in a behavior despite its negative effects, decreased control over participation in the behavior, compulsive participation, and appetitive or craving urges that instantly precede engagement in the behavior (10). Behavioral addictions has essential feature of failure to resist an impulse, drive, or temptation to perform an act or lost control over the rate, frequency, or duration of an activity. The failure to control in these behaviors ultimately leads to a significant negative consequences and interferes with functioning in other domains (11, 12).

Smartphone addiction has been classified as a behavioural addiction, which do not involve the use of a chemical substance as in substance use disorders. However, the similarities of the cardinal features of both substance use disorders and smartphone addiction are striking. Both substance use disorders and behavioural addiction may be described as disorders which involve a loss of control over a compulsive, time- and resource-consuming behavior that persists despite adverse consequences. The behaviour continues to escalate and when the behaviour is reduced there are withdrawal

symptoms (13). Earlier, Shaffer (14) defined behavioral addiction as a disorder characterized by, firstly behavior which functions to produce pleasure and relieve pain and stress, and secondly failure to control or limit this behavior despite known significant harmful consequences.

Official diagnostic criteria for smartphone addiction do not yet exist. As it is a relatively new concept, it is not yet included in the latest version of the Diagnostic and Statistical Manual (DSM-5). Despite that, research studies have been conducted worldwide in order to understand the condition in various aspects. Soni et al. (15) from India in 2017 reported that 33.3% of the participants in their study were at higher risk to develop smartphone addiction. While in Lebanon, the percentage of students who are at high risk of smartphone addiction was 44.6% (16). In Malaysia, a study done by Ching et al. (17) revealed that the prevalence of at-risk case for smartphone addiction among medical students was 46.9% while another study in Kuantan by Pasi et al. (18) reported a higher prevalence of at risk case for smartphone addiction which was 50%.

2.2 Risks for Smartphone Addiction

A numbers of studies were done on investigating the factors that could lead to smartphone addiction. From the literature, risk factors for smartphone addiction could be classified based on socio-demographic characteristics, smartphone usage characteristics, psychological factors and personality traits (19, 20).

Young age, students or undergraduates were found to be vulnerable to smartphone addiction (21, 22). This is because, young populations are digital natives who were born and grown up surrounded by smartphones and technologies, hence they integrated this instrument into their lifestyle and identity (23). Most studies reported that there were sex differences on developing smartphone addiction. Majority found

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that female has more smartphone addictive symptoms and have problematic smartphone use (20, 24, 25). They hypothesized that women are likely to become addicted to the smartphone as they are more socially oriented and more prone to get emotional stress than men. These lead to women spending more time on the smartphone to maintain social interaction and as a way to reduce stress. Apart from that, socioeconomic status was also found to be related to addictive smartphone use, however the results were inconsistent. Some studies reported that lower socioeconomic status is related to problematic smartphone use (26-28), while other studies found the opposite conclusion (19, 29). Interestingly, there were also studies which found that humanities students were more likely to use smartphone more problematically than science students (19, 30). They explained this as due to different behaviour tendencies such as problem-solving skills that lead to smartphone addiction.

Sahin et al. (27) found that lower age (less than 13) and longer duration of smartphone usage (more than five hours per day) were associated with high level of smartphone addiction. Dermici et al. (31) and Long et al. (19) also found that higher duration of daily usage time (longer than four hours daily) was a predictor to smartphone addiction. Several studies found that the content of smartphone use also predicted smartphone addiction, in which people who use the smartphone for social networking services (SNS), games and entertainment were likely to develop smartphone addiction (32, 33).

In view of personality traits, addictive-like behaviors could be considered as consequences of distraction, neuroticism (21, 34), extraversion (21), impulsivity (22, 24), low self-efficacy and shyness (35). This is also applied to the addictive behaviour

towards smartphone. The above studies found that people with these traits has higher risk for smartphone addiction.

Previous research also consistently reported that psychopathological symptoms such as anxiety and depression were associated with various addictive and excessive behaviors, including addictive smartphone use (25, 36). People with depression and anxiety might excessively use a smartphone to escape from the depression and anxious feelings. Stress was also found to be positively associated with smartphone addiction (19, 34, 37) as a stressed person tends to spend more time on the smartphone to alleviate the tension and to experience the pleasure from that rewarding activity. Smartphone addiction was conceptualized as a maladaptive coping strategy in facing stressful situations (19).

2.3   Implications from Smartphone Addiction

Studies found that smartphone addiction could lead to various worrisome physical and psychological problems (7, 38). This suggests that over-usage may also bring the adverse effects in the realms of physical health, psychological well-being and interpersonal relationships, as well as academic performance.

In relation to physical health, Al-Khlaiwi and Meo (39) in Saudi Arabia linked the use of mobile phones with multiple health hazards. They found that among the physical effects were headaches (21.6%), sleep disturbances (4.%), tension (3.9%), fatigue (3%), and dizziness (2.4%). Another Saudi Arabian study later found that 44.4% of the medical students participating in the study attributed their fatigue, decreased concentration, headaches, memory loss, and hearing loss to mobile phone use.

Excessive smartphone use which could lead to smartphone addiction can also affect the psychological and interpersonal well-being of a person. Studies found that it could decrease real-life face-to-face social interaction, decrease academic ability (40), and associated with physical and mental health-related problems including blurred vision, wrists or back of the neck pain (41), anxiety and depression (36). Long et al. (19) has mentioned in their study that rather than a unidirectional pathway, stress actually reflects a reinforcing spiral association with smartphone addiction. This was supported by a study that mentioned smartphone overuse itself could lead to "technostress" which is defined as stress caused by communication and information overload (42).

CHAPTER 3

OBJECTIVES

3.1   General Objective

The aims of this study are to assess the level of risk of smartphone addiction (ROSA); and factors contributing to the smartphone addictive behaviour among students of School of Health Sciences Universiti Sains Malaysia (SHSUSM).

3.2   Specific Objectives

1.   To determine the level of ROSA (mean score of smartphone addiction scale) among students of SHSUSM.

2.   To examine the association between socio-demographic variables, smartphone use characteristics and psychological distress level and level of ROSA among students of SHSUSM.

CHAPTER 4

MANUSCRIPT

4.1   Manuscript

TITLE: FACTORS ASSOCIATED WITH RISK OF SMARTPHONE ADDICTION AMONG UNDERGRADUATE UNIVERSITY STUDENTS IN KELANTAN

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ABSTRACT

Background: Excessive smartphone use could lead to addiction. Smartphone addiction becomes a recent concern because of its potential to adversely impact on many aspects of life. The aim of this study is to assess the level of risk for smartphone addiction and to identify the predictors on the smartphone addictive behaviour among undergraduate university students in Kelantan.

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Conclusion: Stress and daily smartphone usage time are significant predictors for risk of smartphone addiction. This knowledge could help in early detection of smartphone addiction among undergraduate university students, subsequently to plan for early intervention in order to prevent further negative implications of smartphone addiction.

Keywords: *Smartphone addiction, predictors, stress, students, university*

INTRODUCTION

Smartphone addiction is now a rapidly emerging global issue (1). Eventhough the concept of smartphone addiction remains controversial and being debated but it has some scientific and clinical heuristic value. Smartphone addiction is a type of behavioural addiction, which was featured by six core components: salience, mood modification, tolerance, withdrawal symptoms, conflict, and relapse (2). Griffiths (3) described the concept of smartphone addiction as over engagement in the activities related to the smartphone usage, including failure to resist the temptation to use and lost control over the rate, frequency, or duration of the smartphone usage. The failure to control the repetitive engagement ultimately leads to a significant negative consequences and interferes with the individual functioning.

To date, there are no established diagnostic criteria for smartphone addiction. It is a challenge to put a diagnosis of smartphone addiction to a person. Various areas need to be considered as smartphone use also known to have positive outcome and benefit. For example, it is inappropriate to label someone as addicted to smartphone if the person spends much time on it for good purposes such as for academic or health-related or behaviour change interventions (4). There are several scales developed to be used as survey instruments to estimate the prevalence of the problem. There are Smartphone Addiction Scale (SAS) (5), Smartphone Addiction Scale for College Students (SAS-C) (6) and The Mobile Phone Problem Usage Scale (MPPUS) (7).

Smartphone addiction was found to be more common in the students (5) and the younger age group between the age of 18 to 29 (8). This age group represents young adults including college and university students. It has been reported that smartphone addiction could lead to multiple physical and psychological consequences including

physical symptoms such as neck and wrist pain (5), interfering with academic performance, lead to interpersonal relationship problem (9) and psychological disturbances such as anxiety and depression (10).

The knowledge regarding the predictors of smartphone addiction is essential in order to understand the condition, for early detection and prevent the negative implications. Among the identified risks of smartphone addiction were: students, low education level (5), female, internet use, alcohol use, and anxiety (11). In the local setting, very limited studies were done on predictors of smartphone addiction. A study by Pasi et. Al. (12) in 2016 found that prevalence of smartphone addiction among pre-clinical medical students of IIUM Kuantan is 50.0%. The Smartphone Addiction Scale-Short Version was used in the study. Year of study and the average number of hours spent on the smartphone were factors found related to smartphone addiction. They also found that sex, household income, monthly expenditure and the primary purpose of using smartphone were not significantly related to smartphone addiction. Locally, psychological distress such as depression, anxiety and stress state (13) which commonly prevailed in students (14) have not been studied in relation to smartphone addiction.

In undergraduate students, smartphone addiction could serve as a barrier to graduate on time resulting from the decrease in academic achievement (15). Hence, it is important to explore further on the risk factors for smartphone addiction among them to detect early, and prevent negative impacts of the condition. The aims of this study are to determine the level of risk for smartphone addiction and to identify the factors associated with the smartphone addictive behaviour among undergraduate university students in Kelantan.

METHODS

Study design and Procedures

This is a cross-sectional study conducted in the School of Health Sciences, Universiti Sains Malaysia (SHSUSM), Kelantan between October 2016 till May 2017. A total of 140 undergraduate students from year 1 to year 4 of SHSUSM were included. The multistage cluster sampling method was used where five out of ten study programs were first selected randomly, followed by random selection of one out of four academic years from each selected study program. All students in these clusters who fulfilled the inclusion criteria were enrolled. The inclusion criteria were; aged between 18 to 25 years old, owned and used a smartphone and able to read and write in Bahasa Melayu.

The participants were approached at the end of a lecture session in their faculty. Then, those who are consented were given three sets of self-report questionnaires including socio-demographic and smartphone use characteristic proforma, Smartphone Addiction Scale Malay version (SAS-M) and Depression Anxiety Stress Scales 21 Malays version (BM DASS 21). Once completed, the researcher checked for the completeness of each of the questionnaire to avoid missing values.

Ethical Approval

This study was approved by the Human Research Ethics Committee of University of Science Malaysia (USM/ JEPeM/ 16100379).

Measures

Socio-demographic and smartphone use characteristic proforma

Data on age, sex, ethnic, year of study, study program and monthly family income were collected. Additional information on age at the first time used smartphone; daily smartphone usage time and main smartphone use were assessed.

Smartphone Addiction Scale Malay version (SAS-M)

The SAS is a 33-item, six-point likert-type self-rating scale developed by Kwon et al. (5) which measures the level of risk for smartphone addiction. The scale range from 1 (strongly disagree), to 6 (strongly agree) and the total score ranges from 33 to 198. Higher scores indicate a higher risk of smartphone addiction. There was no cut-off point reported in the original scale. The Cronbach's alpha of the SAS is 0.967.

The Malay version of the SAS was used in this study. It had been translated to Malay language and validated among educated Malaysian young adults in a local study by Ching et al. (16). There are six factors corresponding to the SAS subscales were referred to as "cyberspace-oriented relationship", "daily life disturbance", "primacy", "overuse", "positive anticipation" and "withdrawal". It has good internal consistency; Cronbach's alpha coefficient for the total scale was 0.94, and the respective coefficients for the six factors were 0.877, 0.843, 0.865, 0.837, 0.865 and 0.861. The parallel reliability of the SAS-M and the test-retest reliability after a 1-week interval were found to be good, with ICCs of 0.95 and 0.85, respectively.

Depression Anxiety Stress Scale 21 Malay version (BM DASS-21)

The Depression Anxiety Stress Scales 21 (DASS-21) is a self-reporting scale designed to measure three related negative emotional states namely depression, anxiety and stress. It was widely used internationally and locally; both in clinical or non-clinical settings. Each item is scored from 0 (did not apply to me at all over the last week) to 3 (applied to me very much or most of the time over the past week). The BM DASS-21 was used in this study. It had been translated to Malay language and validated in a local study by Ramli et al. (17) with good Cronbach's alpha values of 0.84, 0.74 and 0.79; for depression, anxiety and stress; respectively. Most items have good factor loading values but the ranges were from 0.39 to 0.73. Correlations among scales were between 0.54 and 0.68.

Statistical Analyses

The final data were analyzed using IBM Statistical Package for the Social Sciences Statistics (SPSS) Version 22. All categorical variables were described as frequency and percentage (%). Continuous variables were described as mean and standard deviation (SD) or median and interquartile range (IQR). Simple linear regression (SLR) analysis was performed to determine the association between each independent variable with the risk of smartphone addiction. The variables with p value of <0.25 or clinically important were selected and further analyzed using general linear regression (GLR) analysis.

RESULTS

A total of 140 participants completed the questionnaires. The majority of them were female (85.0 %) and from Malay ethnicity (77.1%). The mean age of the participants was 21.46 years (SD 0.99). Five study programs were Audiology, Exercise and Sports Science, Forensic Science, Nutrition; and Environmental and Occupational Health (EOH). The biggest group was from Forensic Science and the smallest group was from Audiology. Two thirds of the participants were from Year 2 of study and the remaining were year 3 students.

The mean beginning age of starting using the smartphone was 15.8 years (SD 2.6), the youngest was 9 years old. More than two third of them (78.6 %) used the smartphone for more than 4 hours per day. The majority of the participants were using their smartphone for social networking services (SNS) (75.7 %) and only a small proportion (7.9 %) reported that their main smartphone use was for normal phone use such as making calls and sending conventional text messages (the short messaging system–SMS). None of the participants reported that other online services such as online banking or online shopping as their main use of the smartphone. The details of the descriptive measures of the socio-demographic features and basic characteristic of smartphone use of the participants are presented in Table 1.

The participants' mean SAS-M score was 111.07 (SD 25.11) and median of depression, anxiety and stress were 6.00 (IQR 10.00), 9.00 (IQR 10.00) and 12.00 (IQR 12.00), respectively (Table 2).

Table 3 shows the results of simple and general linear regression analysis for SAS-M. The simple linear regression analysis found eight independent variables that were significantly ($p < 0.25$) associated with risk of smartphone addiction. They were

study program (audiology, EOH), monthly family income (income less than RM1000 and between RM1001 to RM3000), daily smartphone usage time, depression, anxiety and stress level.

Of these, the general linear regression analysis indicated that daily smartphone usage time and stress level were found to have a significant positive relationship with risk of smartphone addiction. Audiology study program and monthly family income less than RM1000 have a significant negative relationship with risk of smartphone addiction. The adjusted regression coefficient (b) for stress level score was 0.78 (95% CI: 0.25, 1.31, p = 0.004), that for daily smartphone usage of more than 4 hours was 13.63 (95% CI: 4.18, 23.08, p = 0.005), that for Audiology study program was -12.98 (95% CI: -24.43, -1.54, p = 0.027) and that for monthly family income of less than RM1000 was 12.52 (95% CI: -21.54, -3.50, p = 0.007). Thus, the SAS-M score is 0.78 units higher for each one unit increase in stress level score; participants who used smartphone for more than 4 hours per day have SAS-M score that is 13.63 units higher than subjects who used smartphone less than 4 hours per day; participants in Audiology study program have SAS-M score that is 12.98 units lower than the participants in other study programs and participants with monthly family income of less than RM1000 have SAS-M score that is 12.52 units lower than participants who are from family with monthly income more than RM1000. The R^2 of the final model was 0.178, indicating that it explains 17.8% of the variance.

DISCUSSION

The undergraduate students in this study had a relatively high level of risk for smartphone addiction with the mean SAS-M score of 111.07 (SD 25.11) which is similar to the results of the study conducted by Kwon et al. in South Korea (5), the country that stands out as the country with the highest smartphone ownership rate (18). This is greater than the mean SAS-M score reported by studies in Turkey and India with the mean SAS-M score of 75.6 9 (SD 22.46)(10) and 85.66 (SD 23.46)(19), respectively. This study did not use any cut off score to group the participants based on their SAS-M score. However, there are studies which have classified their participants into low and high smartphone use group based on the median value of SAS scores in their study, which were 72 (10, 19). Another study by Ching et al. (16) used SAS-M score of 98 as the cut off score to differentiate at risk and not at risk case.

If the above cut off scores were used in this study, the mean SAS-M score of the participants are high and at risk for smartphone addiction. This study finding is expected as the participant's age group in the current study was reported to be the age group of the main smartphone user in Malaysia. Furthermore, the previous study found that young age group reported greatest problematic use in mobile phone (20) and Smetaniuk (8) found the highest rate of smartphone addiction were from the age group of 18 to 29.

From our study, we found that there are two variables have a significant positive relationship with the risk of smartphone addiction, hence considered as the predictive factors for smartphone addiction. The two variables were the daily smartphone usage time of more than four hours and stress level. On the other hand, two

more variables have a significant negative relationship with risk of smartphone addiction: Audiology study program and monthly family income less than RM1000.

Among the characteristic of smartphone use, only the duration of daily smartphone usage of more than four hours was found to have positive association with risk of smartphone addiction. This finding supports the previous findings by Demirci et al. (21) and Long et al. (22). The longer time spent on the smartphone per day could indicate that a person was actually dependent on the smartphone, hence addicted to it. However, in interpreting this finding, other aspects of the assessment for smartphone use should also need to be considered, such as the user's profile, the actual use and also the problematic use. For example, by determining the actual use or percentage of usage related to social versus professional purposes, one would not be consider having risk of smartphone addiction if the usage was for professional or beneficial use. Indeed, certain individuals may spent much time on smartphone everyday without being involved in any kind of problematic use that could lead to addiction (23).

However, this study did not find that lower age for the first time of smartphone usage is associated with higher risk of smartphone addiction as reported by Sahin et al. (24). For the content of smartphone use, some studies reported that those who use smartphones for SNS, games, and entertainment were more likely to be addicted to smartphones (25, 26). SNS not only changed the pattern of human communication and interaction, they also have the potential to create intense interactions which lead to addiction to it directly, and towards smartphone indirectly. However, in this current study, even though majority of the participants use smartphone mainly on SNS (75.7%), the regression analysis did not find any significant association with the risk of smartphone addiction.

This current study found that stress level has significant positive association with the risk of smartphone addiction while depression and anxiety were not. This finding was consistent with numbers of study which reported that various stresses (life-, social-, family- and emotional stress) were significant factors that predict smartphone addiction (6, 22, 27, 28). This result may be explained by the fact that university students tend to spend more time on the smartphone to alleviate the negative emotions and experiences caused by the stress. A stressed person has increased demand for pleasure (28), which could be provided by the pleasant feeling following dopamine and endorphin release in the process of behaviour addiction (29). Besides, smartphones offer a relatively safe environment to a stressed person where the person does not have to communicate, socialize, or present themselves in real-life. A stressed person tends to use internet and smartphone more in order to manage moods, compensate for social interaction as well as to escape from reality; without realizing that it was a maladaptive coping strategy (30). Apart from stress, this study finding was inconsistent with a few studies that reported anxiety and depression were associated with smartphone addiction (8, 11, 27, 31). A depressed person usually has symptoms of social withdrawal which are opposite to the purpose of using the smartphone that is for social connection (32). This could possibly explain the above finding.

From the list of socio-demographic variables that was included in this study, two of them were found to have significant negative association with smartphone addiction which were the monthly family income less than RM1000 and Audiology study program. First, monthly family income of less than RM1000 was found to have a significant negative relationship with risk of smartphone addiction. This result reflects those of Long et al. (22) who found that higher family income to be a risk factor for smartphone addiction. Less financial constraint leads to more excessive use of

smartphone which ultimately results in addiction towards it. In contrast, with lower financial status, the students were more restricted on buying the smartphone as well as not afford to spend much money on smartphone data usage. However, there were also studies which contrasted the current study finding (24, 33, 34). They found that low-income individuals were more susceptible to negative health effects of smartphone addiction. It was suggested that low-income individuals overuse smartphones as a sort of compensation and for self-assertion as well as they used smartphone longer as a means of escape from depression and financial pressures.

Apart from that, Audiology study program also was found to have significant negative association with the risk of smartphone addiction. In general, studies found that majoring in science or received education in science during high school had a lower risk for smartphone addiction, whereas students majoring in humanities were more vulnerable to smartphone addiction (22, 34). However, since participants in this study were all majoring in science, the above studies finding was not able to explain our result in this current study. The other factor which should also to be considered when interpreting this result is the small and unequal number of the samples in this subgroup; in which Audiology program had the least subject (13%) compared to other four study programs which have almost equal distribution of participants (20 – 25%). This could have led to the above finding.

Many studies evaluating on the sex differences on smartphone addiction observed inconsistent results. This study found that there was no significant association between sex and risk of smartphone addiction. This finding was consistent with several other studies which found that there was no sex difference was identified regarding smartphone addiction (20, 21, 35). There are several possible explanations

for this. First, the features of the latest generations of smartphones which provide numerous functions could have attracted both sexes to use them, consequently promote excessive use in both males (e.g., games used) and females (e.g., SNS). Second, since this study population was university students of almost in the same young age, both sexes might use the smartphone equally and frequently for social and academic purposes. Thirdly, the unequal proportion of the subjects in terms of sex in this study (15% male vs. 85% female) could probably have caused the insignificant effect. In contrast to the above findings, some studies also reported sex difference on smartphone addiction .Takao et al. (7) reported that sex appeared to be a weak predictor of problematic mobile phone use. Several reports have shown that female has higher risk of developing smartphone addiction than male (10, 21, 36). Whereas, another study reported that female was associated with higher levels of smartphone addiction while male was associated with internet addiction (11).

There are few limitations in this study. First, the cross-sectional design hindered any causal interpretation of the relationships shown between smartphone addiction and other variables. A longitudinal research design could be done in the future to effectively verify the causal relationships between the above-mentioned variables. Second, the study was conducted in only one university, which limits the generalizability of the findings. It is highly recommended that large-scale studies with national sample populations with different educational and age backgrounds to be done in the future. Third, there is potential response bias from the data collection that was based only on self-reports. The influence of response bias could be lessened by reversing half of the questions on each scale or use more qualitative approach during data collection.

Conclusion

From this study, it was identified that daily smartphone usage time and stress level were positively associated with the risk of smartphone addiction. Whereas, lower monthly family income and being in Audiology study program were found to have negative association with the risk of smartphone addiction. However, interpreting the association between daily smartphone usage time and Audiology study program with the risk of smartphone addiction should consider few other factors as discussed earlier. The implication of this is the possibility for early detection of the students who are at risk for smartphone addiction. It was suggested that future studies investigate the relationship between uses of smartphone for certain specific activity (such as SNS, gaming, etc.) and mobile phone addiction. This study is among the earliest local study to identify predictive factors for risk of smartphone addiction especially looking at the psychological distress. It will serve as a base for future studies on this particular field. Further research might explore on smartphone addiction at other populations such as school students or adolescents as well as adult. Future studies also can consider establishing promotion on smartphone addiction to raise the awareness about the condition or intervention programs in order avoid the negative effects resulting from this addiction.