SMARTPHONE ADDICTION AND DEPRESSION: PREVALENCE, SOCIODEMOGRAPHIC FACTORS AND ITS ASSOCIATION WITH SEVERITY OF DEPRESSION

DR. LIM POH KHUEN

DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF PSYCHOLOGICAL MEDICINE

DEPARTMENT OF PSYCHOLOGICAL MEDICINE
UNIVERSITY OF MALAYA
KUALA LUMPUR

2019

UNIVERSITY OF MALAYA
ORIGINAL LITERARY WORK DECLARATION

Name of Candidate: LIM POH KHUEN

Matric No: MGC150008

Name of Degree: MASTER OF PSYCHOLOGICAL MEDICINE

Title of Dissertation/Thesis:

SMARTPHONE ADDICTION AND DEPRESSION: PREVALENCE, SOCIODEMOGRAPHIC FACTORS AND ITS ASSOCIATION WITH SEVERITY OF DEPRESSION

Field of Study: PSYCHOLOGICAL MEDICINE

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SMARTPHONE ADDICTION AND DEPRESSION: PREVALENCE, SOCIODEMOGRAPHIC FACTORS AND ITS ASSOCIATION WITH SEVERITY OF DEPRESSION

ABSTRACT

The recent increase in smartphone usage is a worldwide phenomenon, bringing about a stronger reason for researches to focus on its potential benefits and hazards on the health of the population. Prior studies have found negative effects on both physical and psychological health with increased amount of smartphone use. Literature has revealed that there is a bidirectional relationship between smartphone addiction and depression, with most studies concluding the detrimental effect of excessive smartphone usage on mental health. The aim of this study is to determine the prevalence of smartphone addiction among depressive patients, and to investigate the associated socio-demographic factors related between severity of depression and smartphone addiction. It also aims to investigate the relationship between smartphone addiction and severity of depression. This is a cross-sectional research conducted among depressive patients in the Outpatient Psychiatry Clinic, University Malaya Medical Centre (UMMC). Subjects who met the inclusion and exclusion criteria were included into the study. Participants were interviewed using the clinician rated Mini International Neuropsychiatric Interview (M.I.N.I) and Montgomery-Asberg Depression Rating Scale (MADRS). They were also given self-reported questionnaires which included a socio-demographic information, the Smartphone Addiction Scale (SAS), and Multidimensional Scale of Perceived Social Support (MSPSS). Ethical approval was obtained from the UMMC Medical Research Ethics Committee (MREC ID No: 201866-6365). The results were analysed using

Statistical Package for Social Sciences (SPSS) version 23. A total of 140 subjects were recruited into this study. The prevalence of smartphone addiction among depressive patients was 58.6%, n = 82. The median age was 32 years old. Majority of the subjects were female (72.1%), Chinese race (48.6%), non-married (66.5%), non-professional (38.6%), had university educational level (52.9%), and with monthly household income of above RM5000 (30.7%). On smartphone usage, 40.7% of subjects spent more than 6 hours per day. Analysis of covariate (ANCOVA) showed that the time spent on smartphone was significantly associated with smartphone addiction ($p<0.001$) after adjusting for confounders. However, there is no relationship between smartphone addiction and severity of depression. No association was found between smartphone addiction and the severity of depression. The negative association between smartphone addiction and depression severity allows clinicians to be more confident in introducing smartphone applications to aid in the monitoring and treatment of depression. As anyone may develop smartphone addiction regardless of socio-demographic factors, this study calls for more interventions in the future to reduce smartphone addiction among depressive patients and the general population.

KETAGIHAN TELEFON BIMBIT PINTAR DAN KEMURUNGAN: PREVALEN, FAKTOR-FAKTOR SOSIO-DEMOGRAFIK DAN HUBUNGAN DENGAN TAHAP KEMURUNGAN

ABSTRAK

Penggunaan telefon pintar semakin meningkat di seluruh dunia. Fenomena ini memberikan lebih banyak sebab kepada penyelidik untuk fokus pada isu tentang kebaikan dan keburukan telefon pintar kepada kesihatan populasi. Kajian telah menunjukkan bahawa pengunaan telefon pintar yang melebih akan memberi kesan negatif pada seseorang dari segi fizikal dan psikologikal. Hubungan antara penggunaan telefon pintar dan kemurungan adalah dua hala. Kebanyakan kajian telah membuktikan bahawa penggunaan telefon pintar yang banyak membawa kesan yang buruk pada kesihatan mental kita. Kajian ini bertujuan untuk mengetahui prevalen penggunaan telefon pintar di kalangan mereka yang mempunyai masalah kemurungan. Ia juga bertujuan untuk mengetahui kaitan faktor sosio-demografik dengan kemurungan dan tahap ketagihan telefon pintar. Hubungan antara tahap ketagihan telefon pintar dan kemurungan juga dikaji di kajian ini. Kajian ini menggunakan kaedah keratan rentas dan dijalankan di Klinik Psikiatri, Jabatan Psikiatri Pusat Perubatan Universiti Malaya (PPUM). Subjek yang memenuhi kriteria inklusi dan eksklusi diambil sebagai sampel dalam kajian ini. Mereka ditemuramah oleh doktor terlibat dengan menggunakan instrument soal-selidik *Mini International Neuropsychiatric Interview* (M.I.N.I) dan *Montgomery-Asberg Depression Rating Scale* (MADRS). Subjek seteusnya diberi instrumen soal-selidik yang merangkumi soalan-soalan sosio-demografik, Smartphone Addiction Scale (SAS), dan Multidimensional Scale of Perceived Social Support (MSPSS). Kajian ini telah mendapat

kelulusan dari Badan Etika PPUM (MREC ID No: 201866-6365). Data yang diperolehi telah dianalisis dengan menggunakan *Statistical Package for Social Sciences* (SPSS) versi 23. Seramai 140 subjek telah dimasukkan dalam kajian ini. Prevalen ketagihan telefon pintar di kalangan mereka yang mempunyai kemurungan adalah 58.6%, n = 82. Umur median adalah 32 tahun. Majoriti subjek terdiri daripada perempuan (72.1%), kaum Cina (48.6%), tidak berkahwin (66.5%), golongan bukan profesional (38.6%), tahap pengajian universiti (52.9%), dan pendapatan isi bulanan rumah melebihi RM5000 (30.7%). Soal-selidik penggunaan telefon pintar menunjukkan bahawa 40.7% subjek menggunakan telefon pintar melebihi 6 jam sehari. Analisis kovarian (ANAKOVA) menunjukkan masa penggunaan telefon pintar adalah dikaitkan dengan tahap ketagihan telefon pintar ($p<0.001$). Namun demikian, kajian ini mendapati bahawa tidak terdapat hubungan antara tahap ketagihan telefon pintar dengan tahap kemurungan. Secara kesimpulannya, didapati bahawa tahap ketagihan telefon pintar tidak dikaitkan dengan tahap kemurungan. Hasil dapatan ini adalah sama dengan sesetengah kajian yang lain Ini memberi lebih banyak keyakinan kepada doktor untuk menggunakan applikasi telefon pintar bagi membantu pesakit mereka dari segi pemantauan dan rawatan. Selain itu, lebih banyak intervensi diperlukan pada masa depan untuk mengurangkan masalah ketagihan telefon pintar.

ACKNOWLEDGEMENT

I would like to express my sincere gratitude to both my supervisors Associate Professor Dr Amer Siddiq Amer Nordin and Associate Professor Dr Yee Hway Ann @ Anne Yee for their supervision, suggestions, and guidance in the completion of this thesis.

My sincere thanks to all the clinic staffs in the psychiatry outpatient clinic for assisting and accommodating me throughout the process of data collection.

Also not forgetting my family for helping me to make things easier for me throughout this project.

I am also grateful for having my friend Eu HY for supporting and encouraging me all along.

Lastly, I would like to thank all the patients who participated in this study. I hope that this work will be of benefit to everyone.

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LIST OF ABBREVATIONS

DSM – 5	Diagnostic and Statistical Manual of Mental Disorders, 5th edition
IBM	International Business Machines
MCMC	Malaysian Communications and Multimedia Commission
HPUS 2017	Hand Phone Users Survey 2017
NHMS	National Health and Morbidity Survey
WHO	World Health Organization
MSPSS	Multidimensional Scale of Perceived Social Support
UMMC	University Malaya Medical Centre
M.I.N.I	Mini International Neuropsychiatry Instrument
MADRS	Montgomery-Asberg Depression Rating Scale
SAS	Smartphone Addiction Scale

CHAPTER ONE

INTRODUCTION

A smartphone is "a mobile phone that can perform like a computer, typically having a touchscreen interface, internet access, and an operating system that allows the usage of downloaded apps", as defined by the Oxford English Dictionary. The robust function of smartphone has popularized the use of it, evidenced by the surge of smartphone ownership globally (Statista 2019). In the United States, 72% of the population owns a smartphone (Poushter, 2016), whereas in Malaysia, the smartphone ownership showed a similar percentage at 75.9% (MCMC, 2017).

It is undeniable that smartphone brings about positive benefits, such as optimizing communication, educational benefits, improves the convenience in purchasing goods, and improves health outcomes through behaviour modification applications (S. W. Kim et al., 2016; Rathore, 2016). However, overuse or being dependent on smartphone can lead to hazardous effects physically and psychologically (Akodu, Akinbo, & Young, 2018; Demirci, Akgönül, & Akpinar, 2015). Direct health effects such as harmful radiation (Nath & Mukherjee, 2015) and musculoskeletal pain has been reported (Kee, Byun, Jung, & Choi, 2016). Psychologically, it may cause a deterioration in mental health, especially on depression, anxiety, and sleep disturbances (Demirci et al., 2015).

The increasing amount of time spent by individuals on smartphone use has now, brought about the term smartphone addiction, which is considered as a type of "technological addiction" (Griffiths, 1998), similar to the other behavioural addictions as listed in the

Diagnostic and Statistical Manual of Mental Disorders (DSM-5). To investigate further on the issues related to smartphone addiction, many studies have investigated its use among adolescents (Jeewon Lee et al., 2018), university students (Boumosleh & Jaalouk, 2017), young adults (Chen et al., 2016), and also in adults (Nahas, Hlais, Saberian, & Antoun, 2018). Most of the studies showed the harmful effects of smartphone addiction on mental health and psychological well-being.

From previous work investigating all contributing factors and negative effects related to smartphone addiction, depression is one important factor affecting the level of smartphone use. The relationship between smartphone addiction and depression is known to be bidirectional. This is explained by the fact that excessive usage of smartphone may lead to depression (Boumosleh & Jaalouk, 2017; Demirci et al., 2015), while depressive individuals also tend to engage in higher smartphone usage (Long et al., 2016). However, most study samples were obtained from the general population, and not among depressive patients. Hence this study is conducted to investigate regarding smartphone addiction in subjects who have already been diagnosed with major depressive disorder.

CHAPTER TWO

LITERATURE REVIEW

2.1 Smartphone Usage and Growth

The first usage of smartphone marked its history since 1993 (Sarwar & Soomro, 2013). During that time, the invention of "IBM Simon" by the International Business Machines (IBM) sold around 50,000 units in the United States over a period of 6 months (Sager, 2012). The "IBM Simon" is a device that allows phone call, fax, e-mail, cellular pages, and many other applications such as calculator, stylus input keyboard, calendar, but to name a few. Following which, Blackberry overtook "IBM Simon" and became the first-choice device used for email, fax, internet, camera, and web browsing. However, during the initial stage, smartphone use was mainly targeting the corporations and purely meant for the use in enterprises. It was not until the invention of the iPhone which started to see the use of smartphone among consumers. The first iPhone invented by Apple in the year 2007 stimulated the development of Android Operating System by Google and the boom of other smartphones (eg. Samsung, Nokia, Motorola etc) (Islam & Want, 2014).

Up till today, there are a few operating systems such as iOS, Blackberry OS, Windows mobile, and Android. These systems allow the usage of various applications with many sophisticated features, such as photo taking, notebooks, games, navigation, social-networking function, and many more. Statistics showed that up till the first quarter of 2018, Android's app store which is the largest app store made available a total of 3.8 million apps for consumers to choose from, followed by Apple App Store with 2 million apps available (Statista, 2018). The advancement in development of apps can be seen by how they ease our lives, from the basic to-do-list, till health monitoring, mobile shopping,

tracking your lost phones, education purposes, and even using it as a credit card or identification card. All these functions that are now made available had caused an alarming increase in the trend of using a smartphone.

With the advancement of technology, smartphone has now penetrated worldwide market, especially in the Europe and United States (Poushter, 2016) . A study in 2016 showed that a total of 72% of Americans claim ownership to a smartphone (Poushter, 2016). Whilst the smartphone ownership is on a steady rise in developed countries, the rates in emerging and developing countries are also increasing at a tremendous rate. This is shown in the rise of smartphone ownership from 21% in 2013 to 37% in 2015 in developing countries such as China, Malaysia, and Brazil.

In Malaysia, according to the Hand Phone Users Survey 2017 (HPUS 2017) conducted by the Malaysian Communications and Multimedia Commission (MCMC), the usage of smartphone has been on a steady rise. In fact, this amount has doubled over the past 5 years, from 37.4% in 2013 to 75.9% in 2017. Smartphone device has now overtaken the basic phone and has become the preferable device for most Malaysians to stay connected. In another online study done among 409 Malaysian adults with a mean age of 22.88, 95.4% of them owned a smartphone, and 18.3% of them owned more than one smartphone (Parasuraman, Sam, Yee, Chuon, & Ren, 2017). This corresponded with the survey done by MCMC whereby 17.7% of respondents owned more than one smartphone, and 5.1% owned more than three or more smartphones (MCMC, 2017).

With the smartphone having the capability of functioning like a computer, the usage of it is no more limited to just phone call or text messages. In a survey done across 40 countries,

internet and social media usage are the main reasons for smartphone use. 76% of people who use the internet access social networking sites such as Twitter and Facebook (Poushter, 2016). Other studies supported this finding, with the main usage of smartphone being social-networking and texting (Elhai & Contractor, 2018; Kwon, Lee, et al., 2013; Long et al., 2016; Zulkefly & Baharudin, 2009). This is followed by other functions such as online gaming, listening to music, and taking pictures or videos.

In Malaysia, the MCMC reported that the most common usage is text messaging and voice notes (98.5%), followed by voice calls (93.8%), social networking (88.1%), internet usage (87.5%), entertainment (83.7%), and others (MCMC, 2017). This pattern of usage is also found in our neighbouring country in Brunei (Anshari et al., 2016). With the increasing variety and affordable data package nowadays, video calls via social communication apps such as WhatsApp, Skype, Apple's Facetime, WeChat etc are more widely used. Studies in Malaysia reported similar usage pattern, where the most commonly used function of mobile phone was text messaging (Zulkefly & Baharudin, 2009) and also accessing e-mails and social networking sites (Lubis, 2013). Furthermore, smartphone was also used for learning purposes such as accessing the e-learning portal (Mohamad & Ghazali, 2016).

2.1.1 Positive Impacts of the Smartphone

With a small size that allows it to be held in hands and fits into pockets, the smartphone is now easily available and accessible to most people. Having a processor of a computer that enables the running of complex apps simultaneously and continuously in the

background, many functions can be carried out. The availability of huge memory storage allows the smartphone to be used like an MP3 player where hundreds of songs can be stored, and to watch videos and movies. The advancement in the lens technology captures images as high quality as a camera, and subsequently allowing editing through the apps. The innovation of a smartwatch which is used through pairing with a smartphone offers more possibilities that a smartphone can offer, such as monitoring our vital signs and health status.

In the past few years, smartphones has been also used as a “Mobile Wallet” or “Digital Wallet”(Rathore, 2016). It is now being widely accepted as the mainstream mode of online payment. Consumers can now shop easily due to its ease of use and convenience (Rathore, 2016). Besides allowing for the purchase of goods, the usage of smartphone also contributes in the research field such as the ease of collecting data, running studies, and allowing for field observations and interactive experiments (Miller, 2012). It can be used in various fields, from medical to others such as political science, economics, and social sciences but to name a few.

In the field of medicine, smartphone allows the setup of a portable laparoscopic viewing system (Chatzipapas, Kathopoulis, Protopapas, & Loutradis, 2018). It also allows better monitoring of real-time drinking behaviour via app that may provide useful information to the health-care personnel and public (Poulton, Pan, Bruns Jr, Sinnott, & Hester, 2018). Besides that, smartphone instant messaging app can also be on par with the standard method of viewing radiographic images of picture archiving and communication system (PACS). This enables immediate discussions with experts and allows the delivery of prompt treatment (Stahl et al., 2017).

In terms of patient care, smartphone brings about positive effects that can enhance patients' care and medical education (Valle, Godby, Paul III, Smith, & Coustasse, 2017). The field of travel medicine also saw the usage of smartphone as a feasible tool that allows the collection of health risks data thus allowing innovations to be implemented (Farnham, Blanke, Stone, Puhan, & Hatz, 2016). South Korea has also demonstrated the potential benefits of smartphone app "Safe Patients" in empowering patients to be more knowledgeable of the safety issues thus preventing surgery-related adverse events (Cho & Lee, 2017).

In the field of psychiatry, there are smartphone apps that are being invented to promote mental health and well-being. App such as "Heal Your Mind" developed by Korea has found that there is a potential for the app to monitor and provide cognitive-behavioural treatment to young patients with psychosis (S. W. Kim et al., 2016). Its function was also being explored in patients with bipolar mood disorder to help in monitoring their affective states (Faurholt - Jepsen et al., 2016). A recent study done among individuals with substance use disorders had demonstrated the potential benefits in using smartphone during their recovery period to reduce drug seeking behaviour (Liang, Han, Du, Zhao, & Hser, 2018).

With all the positive benefits of smartphone usage mentioned above, it is now unlikely to live without a smartphone. The smartphone has now become an important aspect of an individual's daily life and had moved on from being merely a "technological object" to an important "social object". However, many studies have raised concerns regarding the consequences of the usage of smartphones (Lanaj, Johnson, & Barnes, 2014; Lemola, Perkinson-Gloor, Brand, Dewald-Kaufmann, & Grob, 2015).

2.1.2 Negative Impacts of the Smartphone

The safety of using a smartphone has long been investigated, especially in pertaining to the exposure to radiofrequency radiation. The signals that are used in mobile communication produces harmful electromagnetic radiation which can cause health problems such as migraine and deafness. Other symptoms that may be experienced are such as burning skin, fatigue, hot ears, and memory loss (Nath & Mukherjee, 2015).

Excessive smartphone use can lead to other health problems such as posture, respiratory function problems (Jung, Lee, Kang, Kim, & Do, 2016), and cranio-cervical area muscular disturbances (Kee et al., 2016; JeonHyeong Lee & Seo, 2014). Moreover, smartphone addiction can also increase the risk of accidents such as falling from height, slipping, collisions, or bumps (H.-J. Kim, Min, Kim, & Min, 2017). As smartphone is now a device that most people carry around, the usage of apps such as WhatsApp while driving has also been shown to pose a danger risk especially among elderly drivers (Ortíz, Ortiz-Peregrina, Castro, Casares-López, & Salas, 2018).

Apart from physical health hazard, smartphone can also impose negative consequences in our daily lives. Late night usage of smartphone can cause sleep depletion which in turn lead to reduction in work engagement the next day (Lanaj et al., 2014). For doctors, using smartphone during inpatient hospital ward rounds was found to be distracting especially during important information transfer, and may affect patients' care and management (Katz-Sidlow, Ludwig, Miller, & Sidlow, 2012). Hence, it is important to monitor the usage of smartphone to reduce the harm brought by it.

2.1.3 Smartphone Addiction and Psychological Problems

The American Society of Addiction Medicine defines addiction as a "primary, chronic disease of brain reward, motivation, memory and related circuitry" (Medicine, 2011). In traditional medical terms, addiction was known as a body and physiological dependence on a physical substance, such as drugs and alcohol addictions. In the late 1990s, the concept of "technological addiction" has been proposed by Griffiths (Griffiths, 1996, 1998). This condition described a behavioural addiction involving excessive interaction between human and machine. In this proposed concept of behavioural addiction, any behaviour which fulfils the symptoms of addiction, such as mood modification, tolerance, withdrawal, salience and relapse can be operationally defined as behavioural addiction (Griffiths, 1998). The concept of addiction being extended from only physical substance to behaviour was supported by other scholars (Lenhart, Simon, & Graziano, 2001; Orford, 2001; Shaffer, 1996).

In psychiatry, the Diagnostic and Statistical Manual for Mental Disorders (DSM-5) in May 2013 has included internet addiction as "internet gaming disorder" under the chapter of "Conditions for Further Study" (American Psychiatric Association, 2013). Another well-known behaviour addiction which is gambling disorder has also been categorized to "substance related and addictive disorders" (American Psychiatric Association, 2013). This further shows the acknowledgement and importance of behavioural addiction, which is now extended to smartphone. Previous studies had shown that behavioural addiction such as internet addiction, pathological gambling, and even instant messaging addiction had brought about negative psychological consequences (Bahrainian, Alizadeh, Raeisoon, Gorji, & Khazaee, 2014; Ciccarelli, Griffiths, Nigro, & Cosenza, 2017). Disturbances in work, sleep, and real-life relationships was found in those with internet addiction

(Batthyany, Müller, Benker, & Woelfling, 2009; Peters & Malesky Jr, 2008), whereas other studies had found negative psychological consequences in having problems with verbal memory and attention (Chan & Rabinowitz, 2006), increased level of stress, and maladaptive coping strategies (Hussain & Griffiths, 2009).

Certain psychological traits such as the need for touch and social interaction anxiety (Y.-K. Lee, Chang, Lin, & Cheng, 2014) is related to compulsive usage of smartphone. There are also a few characteristics or personalities which predispose an individual to smartphone addiction. These psychological predictors are such as neuroticism (Gao, Xiang, Zhang, Zhang, & Mei, 2017), extroverts, low self-esteem (Bianchi & Phillips, 2005), and impulsivity (Wu, Cheung, Ku, & Hung, 2013). In a study conducted in South Korea among adolescents especially those with lower levels of friendship quality and self-control, a past experience of domestic violence and parental addiction were also associated with an increased risk of smartphone addiction (H.-J. Kim, Min, Min, Lee, & Yoo, 2018). Besides that, loneliness and shyness are also two important factors that have been linked to internet addiction and smartphone addiction (Bian & Leung, 2015; Enez Darcin et al., 2016).

Chemical addiction differs from smartphone addiction in a way that the latter causes psychological effects rather than physical effects. Problematic smartphone use is associated with a negative impact on the quality of interactions between friends, especially on face-to-face interactions (Rotondi, Stanca, & Tomasuolo, 2017), and also resulting in less social support (Herrero, Urueña, Torres, & Hidalgo, 2017). Individuals

who spent more time on their smartphones may also suffer from sleep problem (Demirci et al., 2015).

Another main psychological concern associated with smartphone use is anxiety (Ithnain, Ezzat Ghazali, & Jaafar, 2018). Looking at the theoretical model of problematic smartphone use and anxiety symptoms, it was postulated that in order to reduce anxiety and negative emotions, one may turn to smartphone for symptom relief. However, this relationship is likely to be bidirectional, as excessive usage of smartphone can also drive anxiety (Elhai, Levine, & Hall, 2018).

2.1.4 Prevalence of Smartphone Addiction

The prevalence of smartphone addiction varies from country to country. In a study done in Saudi Arabia, a high percentage of students (48%) were found to be smartphone addicts (Aljomaa, Qudah, Albursan, Bakhiet, & Abduljabbar, 2016). The authors attributed it to the possible reasons that smartphone in Arab is inexpensive, easily accessible, and a way to keep up with global modernization. In other countries, the prevalence were lower, such as in the United States among undergraduate students, 10 to 25% of students were found to exhibit problematic smartphone use (Smetaniuk, 2014). This result was rather similar to South Korea whereby 9.6% of adults were found to be dependent on smartphones (Kwon, Lee, et al., 2013), and in British, 10% of adolescents were dependent on their smartphones (Lopez-Fernandez, Honrubia-Serrano, Freixa-Blanxart, & Gibson, 2014). Another study done in China reported a total of 10.54% adolescents who were faced with problematic cellular phone use (Wang et al., 2014), with another one reporting a

prevalence of 21.3% (Long et al., 2016). In Lebanese, 20.2% of adults were found to have problematic smartphone use (Nahas et al., 2018). However, there were also studies which showed a lower prevalence. For example, in a large sample study done in China on 1124 young adults, only 4% of young adults were found to be having smartphone addiction (Chen et al., 2016).

In Malaysia, the prevalence of at-risk usage of smartphone was found to be high at 46.9% (Ching et al., 2015). The authors explained a few possibilities that had led to this result, for instance Malaysians were following the trend on owning a smartphone, engaging in social media platforms, and also using smartphone to listen to songs or play games to relieve stress.

2.1.5 Demographic Variables of Smartphone Usage/ Addiction

According to the statistics from Hand Phone Users Survey 2017 by Malaysia Communications and Multimedia Commissions, 1 out of 4 hand phone users (24.9%) checked their phones constantly even when there was no notification (MCMC, 2017). Upon waking up, 73% checked their phones for messages, and 7.3% would visit social network. Dependency was also seen from the fact that 85.8% of hand phone users especially young adults will turn back to get their phones if they left their phones.

There are multiple factors which could affect the pattern of smartphone usage. Firstly, gender difference in usage of smartphone have been investigated in many studies and

yielded different results. Some of the studies found that female users are at a higher tendency for smartphone addiction (Abo-Jedi, 2008; S.-W. Choi et al., 2015; Demirci et al., 2015; N. Park, 2014). This could be due to the reason that males possess greater interest in gambling, cybersex, and games compared to females who prefer to use the internet for blogging, sending messages, and chatting (Fattore, Melis, Fadda, & Fratta, 2014). Hence, males use more computers whilst females are still able to carry out their favourite activities via smartphone, resulting in a higher risk for smartphone addiction. On the other hand, there are studies which showed otherwise, indicating that male addicts are higher than female addicts (Aljomaa et al., 2016; M.-o. Kim et al., 2015). This is consistent with the findings in Malaysia reported by the MCMC over the past 7 years, with male (58.9%) smartphone users outnumbering the female (41.1%) smartphone users. However, some studies showed that there are no gender differences in the frequency of smartphone usage (Long et al., 2016; Prezza, Pacilli, & Dinelli, 2004).

Age is another factor widely explored by previous studies. Most studies found that younger individual has higher dependency on smartphones compared to older individuals (Smetaniuk, 2014) (Nahas et al., 2018). Furthermore, smartphone addiction at a younger age increases the risk of developing smartphone addiction at a later age (Jun, 2016).

Another factor which affects smartphone use is the family income level. In a study done among Malaysian students, those with higher family income levels were found to spend more time on their smartphones (Zulkefly & Baharudin, 2009). This is supported by another study which has also found that students from families with higher economic levels have higher use of smartphone, possibly due to the feeling of loneliness studying

away from home (Mazaheri & Najarkolaei, 2014). On the contrary, family income level has been found to be negatively associated with smartphone use (Sahin, Ozdemir, Unsal, & Temiz, 2013).

Besides family income level, educational level of an individual could also affect the smartphone usage. Bachelor students were found to be having higher usage of smartphone compared to Masters students (Aljomaa et al., 2016; Tavakolizadeh, Atarodi, Ahmadpour, & Pourgheisar, 2014).

Lastly, marital status has also been found to be associated with smartphone addiction in some studies. A study focusing on social media and video games concluded that individuals who are single was positively related to video gaming and addictive social networking (Andreassen et al., 2016). However, another study in India found that individuals who are single spent significantly lesser time with their smartphones as compared to those who are committed (Nayak, 2018).

As there are various factors that can influence smartphone usage and the results were not conclusive, this study aims to investigate the socio-demographic factors that are associated with smartphone addiction.

2.2 Depression

Depression is a common but serious mental disorder that had affected over 300 million people worldwide (4.4% of the world's population) (Organization, 2017) Reports from the World Health Organization (WHO) showed that this number is on a steady rise, with an increase of 18.4% between the year 2005 and 2015 (Organization, 2017). Each year, around 800,000 deaths occurred due to suicide, and depression is one of the contributing factors for it (Organization, 2018). With a lifetime prevalence of 20 to 30% among the adult population (Kruijshaar et al., 2005), it is also expected to be the leading cause of global burden of disease in high-income countries by the year 2030.

The Diagnostic and Statistical Manual for Mental Disorders (DSM-5) listed the diagnostic criterion for depression as having depressed mood or anhedonia on most days for at least two weeks duration, and at least five out of nine symptoms present (depressed mood, anhedonia, significant weight or appetite changes, sleep disturbance, physical agitation or retardation, fatigue, feeling of worthlessness or guilt, poor concentration, and recurrent death thoughts). When severe enough, these symptoms can cause functional impairment, resulting in the disability of an individual (Hammer-Helmich et al., 2018).

In countries such as England and the United States, the prevalence of depression had risen throughout the years. The Adult Psychiatric Morbidity Survey had reported that 6.2% of the adult population in England had depressive episode (McManus, Meltzer, Brugha, Bebbington, & Jenkins, 2009). In Australia, the 2007 National Survey of Mental Health and Wellbeing found that 4.1% of Australians had depressive episode over the past 12 months. Furthermore, the Australia Women's Health Survey 2018 revealed that as high

as 46.1% of women had been diagnosed by their doctors for having depression or anxiety (Jean Hailes, 2018). With Malaysia being a developing country, depression is not to be taken lightly.

2.2.1 Depression in Malaysia

According to the National Health and Morbidity Survey (NHMS) 2017, 1 in 5 adolescence was found to be depressed, whereas NHMS 2015 reported the prevalence of adult mental health issue at 29.2%. As a result of it, suicide rates have been increasing, and is now the second leading cause of death for those aged 15 to 29 years old, according to the World Health Organization.

In Malaysia, the prevalence varies with different study. This could be due to the differences in the scales that were used, different populations, and different geographical location as mentioned by the authors. In a cross-sectional study done in Selangor, Malaysia, using the Patient Health Questionnaire (PHQ-9), it was found that the prevalence of depression was 10.3% (Maideen, Sidik, Rampal, & Mukhtar, 2014). This finding showed a slightly lower rate compared to another study done among adult female patients in a government clinic setting in Selangor, which gave a prevalence rate of 12.1% (Sidik, Arroll, Goodyear-Smith, & Ahmad, 2012). However, another review article showed the prevalence of depression in Malaysia to be at 3.9 to 46% (Mukhtar & Oei, 2011).

In view of depression as an illness which can affect many aspects of a person's functioning domain, it is hence important to address the issue of depression and to take measure accordingly to fight the illness.

2.2.2 Risk Factors and Protective Factors of Depression

Depression is a common mental disorder that can be affected by various factors, such as genetic, sociodemographic, and environmental factors (Sullivan, Neale, & Kendler, 2000). Having parents with depression increases the risk of the child developing depression (Hammen, Burge, Hamilton, & Adrian, 1990). Besides that, depression is more prevalent among females (Cyranowski, Frank, Young, & Shear, 2000; Rotermann, Sanmartin, Hennessy, & Arthur, 2014).

Lifetime prevalence of depression is shown to be lower in low- and middle income countries (11.1%) as compared to high income countries (14.6%) (Kessler & Bromet, 2013). Marital status also plays a role in depression as reported by several studies whereby the rates of depression are lower in married people (Coryell, Endicott, & Keller, 1992; Parker, Hadzi-Pavlovic, Greenwald, & Weissman, 1995).

There are many evidences now that supports the development of depression due to adverse childhood events such as poor socio-economic status, parental divorce, and childhood emotional and sexual abuse (Mueller-Pfeiffer et al., 2013; Shea, Walsh, MacMillan, & Steiner, 2005; Whitton, Rhoades, Stanley, & Markman, 2008).

Another contributing factor for the risk of depression is the social support perceived by an individual. During the development of the self-reported Multidimensional Scale of Perceived Social Support (MSPSS), it was found that a lower perceived social support was associated with a higher level of depression (Dahlem, Zimet, & Walker, 1991). This is not only true among the general population, but also reflected during the postpartum period whereby there was a significant negative correlation found between the perceived social support and postpartum depression risk (Tambag, Turan, Tolun, & Can, 2018). In a study with large sample size collected across three countries namely Germany, Russia and China, it was found that social support was one of the important protective factors for mental health especially on depression and anxiety (Brailovskaia et al., 2018).

Studies have also shown that personality traits may either be protective or risk factors of depression. Individuals who possess certain personality traits such as low extraversion and high neuroticism were more likely to develop depression than the general population (Kotov, Gamez, Schmidt, & Watson, 2010) (Jylhä & Isometsä, 2006). Those who have lower self-efficacy were also found to be associated to be having higher levels of depression (Bandura, Pastorelli, Barbaranelli, & Caprara, 1999). On the other hand, dispositional optimism was found to be a protective factor against depression (Schou, Ekeberg, Ruland, Sandvik, & Kåresen, 2004).

2.2.3 Association between Depression and Smartphone Use

Prior to studies done among smartphone addiction, extensive research was done on internet addiction. Many studies have found a positive relationship between internet addiction and depression, with those who were internet-addicts demonstrating higher levels of depression (Akin & Iskender, 2011; K. Kim et al., 2006; Young, 1998). Based on studies done on internet addiction, the same theory can be extended to smartphone addiction. Hence, it is not surprising that many studies have found a positive association between excessive smartphone use and depression.

An individual's psychological condition can affect the way of social media use. People who are depressed or lonely tend to seek distractions from their problems by performing other activities such as browsing the internet for temporal relief (Young, 2007). Given the easy and convenient access of media via a smartphone, people may rely on their smartphones to relieve stress and tension. Studies have shown that individuals with emotional instability, depression, low self-esteem and poor self-control had more problematic mobile phone use compared with those without psychological issues (Smetaniuk, 2014). Besides that, people who are depressed also used mobile phone just to pass time. Moreover, those who use their phones in a ritualistic manner have higher risk of developing smartphone addiction compared to those who use their smartphones for instrumental motivations such as information seeking (W. K. Park, 2005).

In a study conducted among college students in South Korea, it was found that depression is a significant predictive factor for smartphone addiction. Students who had higher levels of depression were more addicted to their smartphones (M.-o. Kim et al., 2015), alongside

other factors such as impulsion. In Japan, a study among medical university students shown that depression is an independent predictor for smartphone dependence, as it led to higher immersion in internet connection (Toda, Nishio, & Takeshita, 2015). The above finding was supported by another study in China (Bian & Leung, 2015).

However, there are a few studies which found that depression was negatively correlated with smartphone addiction. In these studies, researchers concluded that the severity of depression is negatively associated with the usage of smartphone. This means to say that greater depression level causes individuals to use less of their smartphones (S.-W. Choi et al., 2015; Elhai, Levine, Dvorak, & Hall, 2017; Elhai, Tiamiyu, et al., 2018). The authors discussed the possibility of depressed individuals who could be having behavioural avoidance, and could have chosen to isolate themselves and hence lessen their engagements in social activities (De Silva, McKenzie, Harpham, & Huttly, 2005).

The association between smartphone and depression is known to be bidirectional. Individuals who are depressed engaged higher in smartphone usage to relieve their negative emotions, but this could eventually cause them to develop problematic smartphone use (J.-H. Kim, Seo, & David, 2015). Not only their depressive symptoms did not improve, but it may worsen their symptoms (Jun, 2016). On the other hand, individuals who spent more time using their smartphones also scored higher in depression levels. In a study done among Turkish university students, overuse of smartphone was found to lead to depression (Demirci et al., 2015). Another study done among adolescents in north-eastern USA demonstrated similar results (Bickham, Hswen, & Rich, 2015). In South Korea, a study done further strengthened the hypothesis by concluding that mobile

phone addiction led to the emergence of depressive symptoms (Jun, 2016). This is supported by another large study done in Saudi Arabia that found a significant positive correlation between smartphone addiction and depression (Alhassan et al., 2018). Several other studies supported the findings of smartphone addiction contributing to higher depression levels (E. Kim, Joo, Han, Kim, & Choi, 2017; H.-J. Kim et al., 2018; Selvaganapathy, Rajappan, & Dee, 2017).

CHAPTER 3

OBJECTIVES

3.1 General Objective

As the relationship between smartphone addiction and depression is unclear based on previous studies, this study aims to explore the relationship between both, and more specifically, looking only into depressive group of patients. The researcher aims to investigate the prevalence of smartphone addiction among depressive patients, characteristics of these patients, and the possible associations of smartphone addiction and depression severity.

3.2 Specific Objectives

1. To determine the prevalence of smartphone addiction among patients who have been diagnosed with major depressive disorder.

2. To examine the characteristics contributing to smartphone addiction in those with depression such as age, race, gender, income level, educational level, occupation, marital status, time spent on smartphone usage, and main reason of smartphone usage.

3. To investigate and determine the relationship between smartphone addiction and severity of depression among patients who have been diagnosed with major depressive disorder.

CHAPTER 4

METHODOLOGY

4.1 Study Design and Sampling Method

4.1.1 Study Design

This is an observational, cross-sectional study to determine the relationship between smartphone addiction and depression.

4.1.2 Period of Study

This study was conducted over a period of 1 month and ceased when adequate sample size was obtained.

4.1.3 Study Population

All patients who attended the outpatient psychiatry clinic or newly admitted to the psychiatry ward in University Malaya Medical Centre who met the inclusion and exclusion criterion were included in this study.

4.1.4 Place of Study

UMMC is situated at the south-west corner of Kuala Lumpur. It has a total of 1439 beds, including in-patient, trauma centre, critical ward, and day-care. This study was conducted

in the Department of Psychological Medicine, University Malaya Medical Centre (UMMC).

4.1.5 Inclusion Criteria

a) Patients who were ages 18 years and up

b) Patients who were diagnosed with Major Depressive Disorder using the Mini International Neuropsychiatry Instrument (M.I.N.I)

c) Patients who can understand and read either English or Malay language

d) Patients who were able to give informed consent

e) Patients who had no other major psychiatric illnesses or psychoses

f) Patients who owns a smartphone

4.1.6 Exclusion Criteria

a) Patients with a severe medical condition and too ill to participate in this study

b) Patients who did not consent for this study

c) Patients who do not own or use a smartphone

d) Patients who are not capable of reading and understanding the English or Malay language

4.2 Data Collection

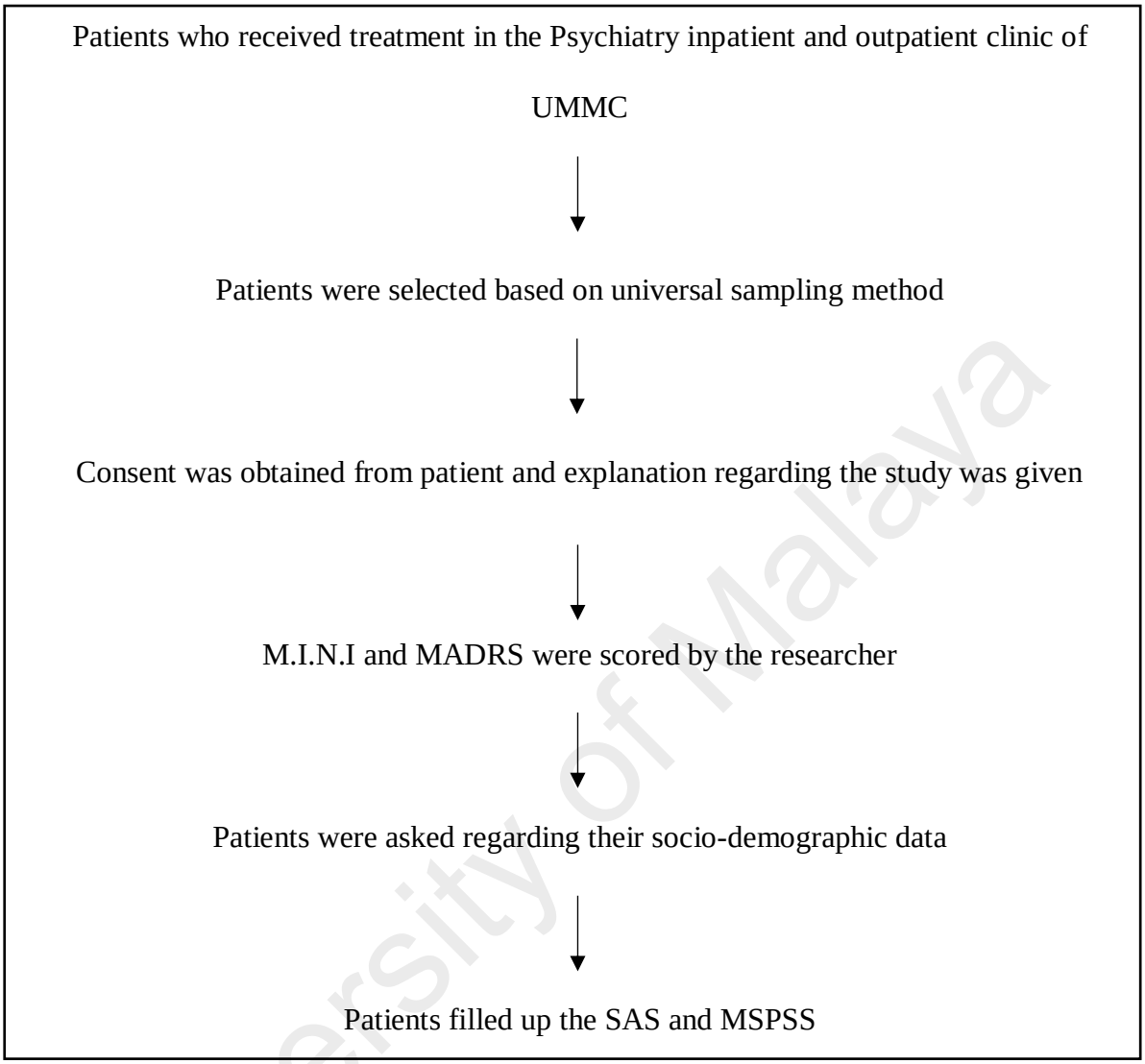
Patients who presented to the Accident and Emergency unit, or the Department of Psychiatry clinic with complains of depressive symptoms were seen by a medical officer and diagnosed accordingly. Relevant investigations were carried out and treatments were given accordingly. If they were treated as out-patient, an appointment date would be given for subsequent follow-ups. However, if the presenting symptoms were severe and required admission, the patient will be admitted to the psychiatry ward for further observation and treatment. Upon discharge, a follow-up date at the psychiatry clinic would be given.

Patients who attended the Psychiatry Outpatient Clinic would be required to register themselves at the registration counter. Once they had registered, their medical records would be accessible via the Electronic Medical Record (EMR) system. From there, patients who were diagnosed with Major Depressive Disorder, regardless of the treatment modality were identified and approached. For the patients who were receiving in-patient treatments, those who were diagnosed with Major Depressive Disorder were approached. Patients who did not use or own smartphones were excluded from this study.

Firstly, the subjects were asked for their consents on this study. The subjects were briefed regarding this study. They were also given reassurances that their personal information such as names and identification card numbers would be kept private and confidential, and that no personal data would be revealed in the final report.

Once the consent was obtained, the researcher proceeded to ask on depressive symptoms based on the Mini International Neuropsychiatric Interview (M.I.N.I) for depression. This was followed by the assessment of severity of depression via the Montgomery-Asberg Depression Rating Scale (MADRS). After the researcher had confirmed that the subject fits the inclusion criteria, the study was continued with socio-demographic questionnaire. Subjects were also asked regarding other depression variables. The subjects were given the Smartphone Addiction Scale (SAS) and the Multidimensional Scale of Perceived Social Support (MSPSS) to answer. Subjects were required to answer both scales in either English or Malay language. For statements in the questionnaires that were unclear to subjects, subjects were encouraged to ask the researcher for further clarification. Once the subject had completed the questionnaires, the researcher would check for any answers that were unclear or missed out. The subjects were also allowed to ask further questions pertaining to this study. Flow chart of the study is as shown in Diagram 4.1.

Diagram 4.1: Flow Chart of the Data Collection



4.3 Sample Size

The sample size was calculated using the single mean formula.

$N = (z\sigma/ \Delta)^2$

Z = Z statistic for a level of confidence

σ = Standard deviation

Δ = precision (in proportion of one; if 5%, Δ = 0.05)

In this study, the standard deviation of smartphone addiction was adopted from a previous study on "Relationship of smartphone use severity with sleep quality, depression, and anxiety in university students" (Demirci et al., 2015). The study found that overuse of smartphone may lead to depression and/or anxiety.

For the level of confidence of 95%, which is conventional, the Z value is 1.96. The standard deviation is 22.46 (Demirci et al., 2015). Δ is set at 5%. With this, the calculated sample size was

$N = [(1.96)(22.46)/5]^2$

$= 77.51$

Considered for design effect and non-response rate of 20%, with a design effect (DEFF) set at 1.5, the calculated sample size would be 77.51 x 1.5 = 116.3. The final sample size would be 116.3 + (116.3x 20%) = 139.6, where N = 140. A total of 140 samples will be collected based on the calculation.

4.4 Instruments

A set of questionnaires was created to obtain information from the subjects. This questionnaire consisted of three parts, mainly the section on clinician-rated assessment on depression, the social-demographic profile, and the self-rated scales.

Section I consisted of socio-demographic, smartphone usage, and depression clinical profile data. Section II consisted of questions on depression, mainly on the symptoms to diagnose Major Depressive Disorder, and the severity of the illness. The scales used were M.I.N.I and MADRAS. Section III consisted of self-rated scales pertaining to smartphone addiction and social support level.

4.4.1 Identification and Socio-demographic Data

The socio-demographic data consists of questions on age, gender, race, monthly combined household income, educational level, occupation, and marital status. It also included basic information on smartphone use, such as the earliest age of using a smartphone, daily smartphone usage hour, and the main smartphone usage. Depression variables which are the presence of family history of depression, age of onset of depression, number of psychiatry ward hospitalizations, previous history of suicidal attempt, and treatment methods were also asked to the subjects.

4.4.2 Mini International Neuropsychiatry Instrument (M.I.N.I)

The M.I.N.I is a short and structured diagnostic interview, initially developed for the Diagnostic and Statistical Manual of Mental Disorders, 3rd Edition, Revised (DSM-III-R) and the International Classification of Disease version 10 (ICD-10) psychiatric disorders (Hergueta, Baker, & Dunbar, 1998). It was developed in 1990 by psychiatrists and clinicians in Europe and the United States. The short administration time of approximately 15 minutes became the choice for clinicians to perform an accurate structured psychiatric interview.

The validity of the M.I.N.I had been tested by the University of South Florida and National Institute for Mental Health in Paris in two parallel studies. Both the Structured Clinical Interview for DSM (SCID-P) and Composite International Diagnostic Interview for ICD (CIDI) were used in the studies. The results showed that the M.I.N.I diagnoses when compared with the SCID-P were characterized by very good kappa values, and very good positive predictive values (above 0.75) for major depression. When compared with CID, the M.I.N.I also displayed good specificity, sensitivity, and good predictive values. Hence, M.I.N.I was concluded as a tool with good reliability and validity in eliciting symptoms, with a shorter duration of time needed when compared with SCID-P or the CIDI.

Till today, the M.I.N.I has been translated and validated in over 70 languages, with the latest M.I.N.I 7.0.2 being updated for DSM-5. It remains as a tool that is well accepted by both patients and clinicians (Pettersson, Modin, Wahlström, af Winklerfelt Hammarberg, & Krakau, 2018). The M.I.N.I English Version 6.0.0 was used in this study.

In Malaysia, the Malaysian Version of MINI for Major Depressive Disorder was validated with overall satisfactory inter-rater reliability (Mukhtar et al., 2012). For this study, the component on major depression was used. It consists of 2 leading questions, with one of them having to be present before proceeding to the following questions. These questions are the core questions in the DSM-5, which are:

A1a. Were you ever depressed or down, most of the day, nearly every day, for two weeks?

A2a. Were you ever much less interested in most things or much less able to enjoy the things you used to enjoy most of the time, for two weeks?

If one or both of the 2 core questions were answered as "yes", the researcher would proceed to ask another 2 questions to determine whether the event happened over the past two weeks. The questions asked are:

A1b. For the past two weeks, were you depressed or down, most of the day, nearly every day?

A2b. In the past two weeks, were you much less interested in most things or much less able to enjoy the things you used to enjoy, most of the time?

If the subjects answered "yes" to either one or both of the questions, the researcher would proceed to ask the subsequent questions for both the current and most symptomatic past episode of depression. However, if the subjects answered "no" to both of the questions, the researcher would proceed to ask the subsequent questions based on the most symptomatic past episode of depression.

To complete the questionnaire, the other questions that were asked would be pertaining to appetite changes, weight changes, sleeping problems, psychomotor retardation or

agitation, symptoms of lethargic, feeling of worthlessness and guilt, difficulty in concentrating or decisions making, or death related thoughts and behaviors.

For a diagnosis of Major Depressive Disorder to be made, the subject would need to score at least 1 in the core questions, and at least 3 in the sub-questions. The M.I.N.I thus allowed the detection of depression for current and lifelong episodes.

4.4.3 Montgomery-Asberg Depression Rating Scale (MADRS)

The MADRS was developed in the beginning to identify the 17 symptoms of depression that most commonly occurred in primary depressive illness (Montgomery & Åsberg, 1979). In the late 1970s, the development of this 10-items scale posed an advantage over the lengthier scales such as the Hamilton Rating Scale (HRS) in terms of time-efficiency. With its high inter-rater reliability and validity, as well as its capacity to detect the responsiveness to antidepressant treatment, the scale was widely accepted and used worldwide.

The MADRS is a ten-item scale which included all the core symptoms of depression. Each item consists of scores from 0 to 6, which yields a total score of 60. The ratings should be based on a clinical interview done by the researcher, who will decide on whether the rating lies on the defined scale steps (0,2,4,6) or in between (1,3,5). The higher the scores, the greater the severity of depression. The best score to differentiate between moderate and severe depression would be a MADRS score of 34, according to

the Clinical Global Impressions Scale (CGI) criteria (Müller, Himmerich, Kienzle, & Szegedi, 2003). To state whether a patient is in remission, the cut off score on the MADRS would be of less than 10 (Hawley, Gale, Sivakumaran, & group, 2002).

Validation of the Malay version of MADRS (MADRS-BM) was done in Malaysia, showing good concurrent validity and reliability (Yee, Yassim, Loh, Ng, & Tan, 2015). With that, its usage in routine clinical practice was justified by the good psychometric properties demonstrated in the study. The 10 items included in the MADRS are apparent sadness, reported sadness, inner tension, reduced sleep, reduced appetite, concentration difficulties, lassitude, inability to feel, pessimistic thoughts, and suicidal thoughts. The researcher would ask each component one by one, and rated the scale based on the answers provided by the subjects. The scale can be completed in 15 to 20 minutes.

4.4.4 Smartphone Addiction Scale (SAS)

The first SAS developed was derived from the Korea Internet Addiction Scale (K-scale), which is a scale used for juvenile internet addiction. From there, modifications were made to replace the term "internet" to "smartphone", as well as adjustment on the scale to allow it to be used among the adult population. The modified version of the K-scale was revised by six professionals in the field of smartphone addiction, namely two psychiatrists, two clinical psychologist, and two counseling psychologists. The Kimberly Young Internet addiction test (Y-scale) was also added to verify the concurrent validity of the first SAS.

The development of the first smartphone addiction scale was proven to be reliable and valid (Kwon, Lee, et al., 2013).

Since the development of the scale, it has been widely used. The SAS consists of 33-items to measure the smartphone usage and addiction. It is a 6-point Likert-type self-rated scale. Each item allows the subjects to provide an answer from a score of 1 to 6. The answering options are such as 1 = strongly disagree, 2 = disagree, 3 = weakly disagree, 4 = weakly agree, 5 = agree, and 6 = strongly agree. An example is item 1 on the SAS pertaining to "Missing planned work due to smartphone use", whereby subjects will answer based on the above 6 options.

The scale has six subscales, namely "daily-life disturbance, positive anticipation, withdrawal, cyberspace-oriented relationship, overuse, and tolerance". "Daily-life disturbance" includes questions on missing planned work, having a hard time concentrating in class or while working, experiencing lightheadedness or blurred vision, feeling pain in the wrists or at the back of the neck, feeling tired and lacking adequate sleep. The second component which is "Positive anticipation" comprises of questions which describe the feelings of calm or cozy, pleasant or excited, confident, feeling most liberal, and being able to get rid of stress with the use of smartphone. It also consists of questions which describe the feeling that there is nothing more fun to do than a smartphone, and life would be empty without a smartphone. The "Withdrawal" subscale of the SAS involves the feeling of impatient and fretful while not holding the smartphone, unable to stand not having a smartphone, having the smartphone in mind even while not using it, never giving up using the smartphone even when one's daily life is greatly

affected, getting irritable when being bothered while using the smartphone, and bringing the smartphone to the toilet even while in a hurry. "Cyber-space-oriented relationship" includes feeling great meeting more people via smartphone, feeling that the relationship with smartphone buddies are more intimate than real-life friends, feeling that smartphone buddies understand him or her better than real-life friends, and prefers talking with smartphone buddies than hanging out with real-life friends or family. Other questions under the same subscale are such as feeling that not being able to use one's smartphone would be as painful as losing a friend, constantly checking smartphone so as not to miss conversations between other people on Twitter or Facebook, and checking social networking service sites right after waking up. "Overuse" subscale refers to the preference of searching from smartphone to asking other people, using smartphone longer than intended, feeling the urge to use smartphone right after stopping the usage, and the fully charged battery does not last for one whole day. The last subscale of the SAS is "Tolerance", defined as failure to shorten smartphone use time despite always trying to do so, always thinking of shortening the smartphone use time, and people around who tell that one uses too much of the smartphone.

The SAS gives a range of score from 33 to 196. It has been validated in Malaysia in the Malay Language (SAS-M), which showed good internal consistency and concurrent validity (Ching et al., 2015). It is also validated in other countries such as Turkey (Demirci, Orhan, Demirdas, Akpinar, & Sert, 2014). However, the cut-off value for SAS was not determined by the author (Kwon, Lee, et al., 2013).

4.4.5 Multidimensional Scale of Perceived Social Support (MSPSS)

The MSPSS is a self-report scale to measure an individual's social support. It was initially developed in the late 1980s on university students and was later extended to different population groups. The MSPSS measures 3 subscales on different source of perceived social supports, namely the Family's support (Items 3, 4, 8, and 11), Friends' support (Items 6, 7, 9, and 12), and Significant Others' support (Items 1, 2, 5, and 10) (Zimet, Dahlem, Zimet, & Farley, 1988). It has a good test-retest reliability, good internal reliability, and a strong factorial validity (Zimet, Powell, Farley, Werkman, & Berkoff, 1990). The 12 items of MSPSS is rated on a 7-point Likert-type scale. It is easy to administer and takes approximately 5 to 10 minutes. The score ranges from 1 to 7, with the options of 1 = very strongly disagree, 2 = strongly disagree, 3 = mildly disagree, 4 = neutral, 5 = mildly agree, 6 = strongly agree, and 7 = very strongly agree. There are 4 items for each source of social support, such as the item number 3 "My family really tries to help me" which assessed the family support.

Up till today, the MSPSS has been translated to at least 22 languages, including the Malay language. The Malay version of the MSPSS (MSPSS-M) has been validated and displayed good psychometric properties. It demonstrated good internal consistency, test-retest reliability, and parallel form reliability (Ng, Siddiq, Aida, Zainal, & Koh, 2010). The total score ranges from 12 to 84. The higher the score is, the greater the level of perceived social support. In terms of scoring, the mean scale scores would be used to assess the level of perceived social support among the subjects. The subjects would be divided into 3 equal groups based on their scores, with the lowest group designated as low perceived social support, the medium group as medium level of perceived social support, and the highest group as the group who received high support (Zimet et al., 1988).

4.5 Statistical Analysis

Data was analyzed using the Statistical Package for the Social Sciences (SPSS) Version 23. Descriptive statistics were used to summarize the data. Continuous variables were represented by mean (standard deviation) or median (IQR), depending on the normality of the data. Categorical variables were represented by percentage. Pearson correlation was used for all continuous variables and outcome variables. Independent t-test was used to investigate the association between the independent variables (SAS/MADRS) and covariates (socio-demographic data and clinical profiles) and the outcome variables (SAS/MADRS). The relationship between smartphone addiction and depression was investigated on both directions. All significantly associated variables under t-tests and correlation were retained for multivariable univariate analysis (ANCOVA).

4.6 Ethical Consideration

This study was approved by the Research Committee, Department of Psychological Medicine in December 2017, and the Medical Research Ethics Committee, University Malaya Medical Centre in July 2018 (MREC ID No: 201866-6365). All participants were assured of the confidentiality of this study. The purpose of this study was also explained to all participants before the commencement of this study. Written obtained consent was obtained from all participants. Coding was used to identify the participants during analysis of the statistical data to maintain confidentiality.

CHAPTER 5

RESULTS

A total of 1487 patients whom presented to the UMMC Department of Psychological Medicine Clinic for consultation via the method of convenient sampling were screened through their records via the Electronic Medical Record (EMR). Out of the 1487 patients, a total of 147 patients who were under follow-up for depression were approached. Out of the 147 patients, 7 patients did not give consent for the study. Among these 7 patients, 4 patients could not read English or Malay language, where else 3 patients could not allocate time for the questionnaires and interviews.

The remaining participants left were 140 patients who agreed to participate for the study. However, 4 did not own a smartphone and were excluded from the study. In the end, a total of 136 patients from the out-patient clinic completed the questionnaires and interviews.

From the psychiatry ward, 4 patients who were diagnosed with major depressive disorder were approached during their day of admission. All 4 of them met the inclusion and exclusion criterion and agreed to participate in this study.

In the end, from both the out-patient psychiatry clinic and in-patient psychiatry ward, a total of 140 patients completed the questionnaires and interviews.

5.1 Socio-demographic Profile of the Study Sample

In this study involving 140 subjects, the median age was 32 years old, with an interquartile range of 23.8 years. The sample age ranges from 19 years old to 69 years old. Majority of the sample was made up of female 101(72.1%). Most of the study sample was from the Chinese race 68(48.6%), followed by the Malay 51(36.4%), and Indian race 21(15.0%).

Data on relationship status revealed that 81(57.9%) of them were single, followed by 47(33.6%) who were married, and the remaining 12(8.6%) were divorced or separated. As for the educational qualification of the participants, more than half of them (52.9%) had university level of education. 20.7% studied up till diploma, 20% had secondary education, and only 6.4% had master or doctorate level education.

Occupational status revealed that non-professional groups were the largest at 38.6%, followed by student (22.1%), professional (20.7%), and the remaining 18.6% were unemployed. More patients 43(30.7%) had monthly household income of more than RM5000, whereas the rest had monthly household income of less than RM5000.

The socio-demographic profile of the participants is listed down in Table 5.1.

Table 5.1: Socio-demographic Profile of the Study Sample (n=140)

Variables	n(%) / Median(IQR)
Gender	
Male	39 (27.9)
Female	101 (72.1)
Age*	32.0(23.8)
Race	
Malay	51 (36.4)
Chinese	68 (48.6)
Indian	21 (15.0)
Marital status	
Married	47 (33.6)
Single	81 (57.9)
Divorced/Separated	12 (8.6)
Educational level	
Secondary	28 (20.0)
Diploma college	29 (20.7)
University	74 (52.9)
Master/Phd	9 (6.4)
Occupation	
Student	31 (22.1)
Professional	29 (20.7)
Non-professional	54 (38.6)
Not employed	26 (18.6)
Monthly household income (RM)	
<1000	29 (20.7)
1001-3000	37 (26.4)
3001-5000	31 (22.1)
>5000	43 (30.7)

* Variable displayed with median (IQR).
IQR = inter quartile range
Variables modification to minimize unequal distribution of data:

Race = Chinese vs non-Chinese, Malay vs non-Malay;

Marital Status = Married vs Non-married; Educational Level = < degree vs ≥ degree

5.2 Clinical Profile of Depression of the Study Sample

The median years for the onset of depression was 3 years. Majority of the subjects did not have a family history of depression (n = 111), and neither did they had past suicidal attempt (n = 111). A total number of 135 (96.4%) subjects were on treatment with medication. Only 27 (19.3%) of them had previous admission(s) to the psychiatry hospital. Medical co-morbidity such as hypertension, diabetes, coronary artery disease were found in a total of 36 (25.7%) subjects.

Table 5.2: Clinical Variables of Depression of the Study Sample

Variables	n (%)
Depression Onset (years)*	3.0 (3.0)
Family history of depression	
Yes	29 (20.7)
No	111 (79.3)
Suicidal attempt	
Yes	29 (20.7)
No	111 (79.3)
Treatment (Medication)	
Yes	135 (96.4)
No	5 (3.6)
Previous admission to hospital	
Yes	27 (19.3)
No	113 (80.7)
Medical co-morbidity	
Yes	36 (25.7)
No	104 (74.3)

* Variable displayed with median (IQR).
IQR = inter quartile range.

The median score for MADRS in this study sample was 23.0, with interquartile range of 19.8. Majority of the subject 59 (42.1%) had moderate depression, while 40 (28.6%) reported to be having mild depression, followed by 25 (17.9%) who had severe depression, and only 16 (11.4%) were in full remission. The result is listed at Table 5.3.

Table 5.3: Severity of Depression of the Study Sample Based On MADRS

Variables	**n % / Median(IQR)**
Montgomery-Asberg Depression Scale (MADRS)*	23.0 (19.8)
Categorical MADRS	
Normal (0-6)	16 (11.4)
Mild (7-19)	40 (28.6)
Moderate (20-34)	59 (42.1)
Severe (>34)	25 (17.9)

* Variable displayed with median (IQR).
IQR = inter quartile range.

Table 5.4 shows the support received by the study samples based on the MSPSS scale. The median score was 57.0 with inter quartile range of 23. The score for significant one was 20 (IQR= 9.0), family 19 (IQR = 11.0), and friends 19 (IQR = 8.8).

Table 5.4: Perceived Social Support of the Study Sample using MSPSS

Variables	**Median(IQR)**
Multidimensional scale of perceived social support (MSPSS)	
Total*	57.0 (23.0)
Significant one*	20.0 (9.0)
Family*	19.0 (11.0)
Friends*	19.0 (8.8)

* Variable displayed with median (IQR).
IQR = inter quartile range.

5.3 Socio-demographic Profile Associated With Smartphone Usage

The median age of the first usage of smartphone was 22 years old, with interquartile range of 20.5 years. In terms of the hours spent per day on Smartphone usage, 21.4% spent more than 9 hours, 19.3% spent between 7 to 9 hours, 24.3% spent 4 to 6 hours, 29.3% spent 1 to 3 hours, and a minority of 5.7% spent less than an hour.

Most of the participants (59.3%) used smartphone mainly for social media purpose, which includes applications such as Facebook, WhatsApp, Instagram, Twitter, Telegram, and WeChat. The other 16.4% of participants used their smartphones mainly for entertainment purposes, 10.7% used for phone calls or short message services, 7.9% used smartphones for learning purposes, 4.3% used smartphones for gaming, and 1.4% used smartphones for other purposes. The result is shown at Table 5.5.

Table 5.5: Distribution of the Study Sample on Smartphone Usage

Variables	n% / Median(IQR)
Age when started to use smartphone*	22.0 (20.5)
Amount of time spent in using smartphone	
< 1 hour	8 (5.7)
Between 1-3 hours	41 (29.3)
Between 4-6 hours	34 (24.3)
Between 7-9 hours	27 (19.3)
> 9 hours	30 (21.4)
Reasons for using smartphone	
Normal communication	15 (10.7)
Learning purposes	11 (7.9)
Entertainment	23 (16.4)
Social media	83 (59.3)
Games	6 (4.3)
Others	2 (1.4)

* Variable displayed with median (IQR).
IQR = inter quartile range. Variables modification to minimize unequal distribution of data: Amount of time spent in using smartphone = ≤ 6 hours vs > 6 hours; Reasons for using smartphone = Social media vs Non-social media

5.4 Prevalence of Smartphone Addiction

Using a SAS cut-off point of 98 in reference to a previous study (Ching et al., 2015), 82 (58.6%) patients were found to be at-risk for developing smartphone addiction. The mean SAS score was 105.8 (SD 27.39).

Table 5.6 Distribution of Patients on Smartphone Addiction Based on SAS Score

Variables	n(%)/Mean(SD)
Smartphone addiction scale (SAS)*	
Mean (SD)	105.8 (27.39)[#]
Categorical SAS using cutoff point at 98, n (%)	
Not at-risk (≤ 98)	58 (41.4)
At-risk (> 98)	82 (58.6)

* Variable displayed with median (IQR), [#] Mean (SD)

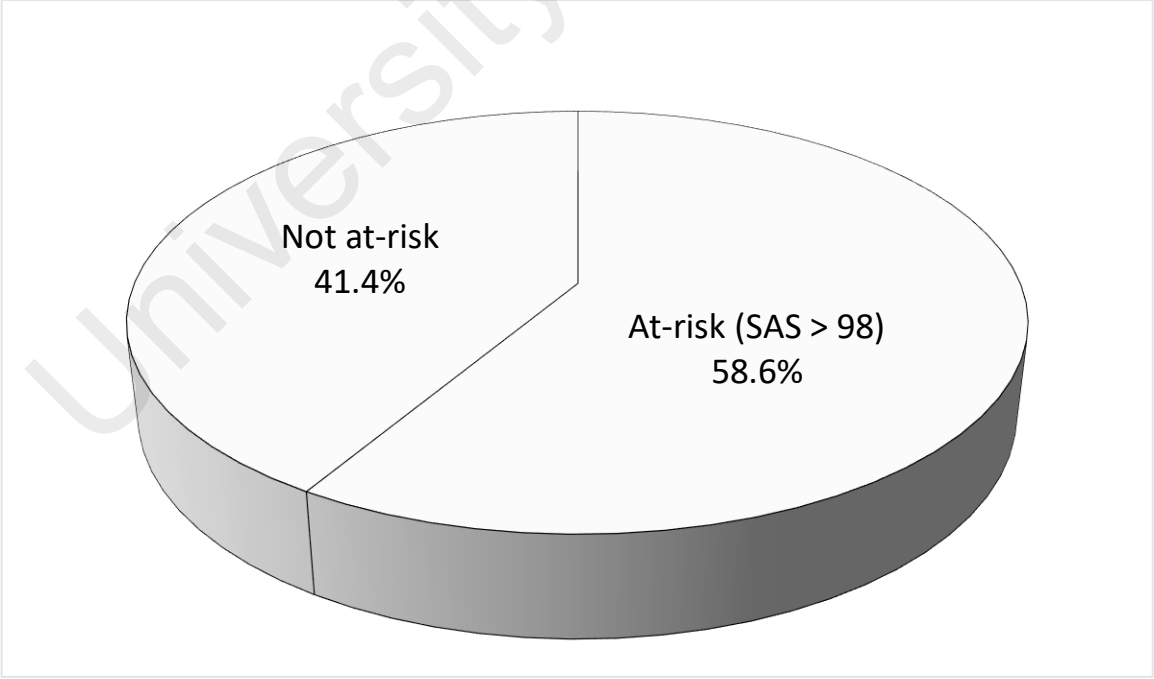


Figure 5.1 Prevalence of Smartphone Addiction Among Patients Based on SAS Score

5.5 Factors (socio-demographic and depression severity) associated with Smartphone Addiction (SAS)

Using multiple T-test, the SAS is analyzed according to overall score together with six subscales, namely "Daily life disturbance, Positive anticipation, Withdrawal, Cyber-space-oriented relationship, Overuse, and Tolerance" (Table 5.7). Severity of depression was categorized into two groups according to MADRS score, which are the normal/mild depression group and moderate/severe depression group. Patients who were in the moderate/severe group scored significant higher in the SAS (overuse) compared to the normal/mild group ($t_{(138)} = -2.224$, $p = 0.028$). Since there were no significant differences in term of scores between the groups in overall SAS and the other subscales, only the SAS (overuse) was used in the subsequent analysis.

Table 5.7: Comparison between normal/mild and moderate/severe depression groups rated by MADRS: SAS (total score and its six subscales)

Outcome (Dependent Variable)	MADRS (Independent Variable)		Mean difference (lower CI, upper CI)	$t_{(138)}$	*P*
	Normal/mild n =56 Mean (SD)	Moderate/Severe n =84 Mean (SD)			
SAS total score	102.43 (24.24)	107.38 (28.13)	-4.952 (-14.043, 4.138)	-1.077	0.283
Daily life disturbance	15.89 (5.60)	17.30 (5.97)	-1.405 (-3.391, 0.582)	-1.398	0.164
Positive anticipation	27.23 (8.68)	26.17 (7.44)	1.065 (-1.649, 3.779)	0.776	0.439
Withdrawal	17.14 (5.23)	18.49 (6.32)	-1.345 (-3.361, 0.671)	-1.319	0.189
Cyber space Oriented relationship	18.68 (6.36)	19.48 (7.82)	-0.798 (-3.279, 1.684)	-0.636	0.526
Overuse	14.14 (5.00)	16.01 (4.79)	-1.869 (-3.531, -0.208)	-2.224	0.028
Tolerance	9.34 (3.87)	9.94 (3.84)	-0.601 (-1.915, 0.713)	-0.905	0.367

Remarks: All significant of Levene's test exceeded 0.05, hence assumption of equal variances are all met.

Through univariate analysis, five variables were found to be significantly associated with the "Overuse" SAS subscale (Table 5.8). These variables were the severity of depression ($t_{(138)} = -2.224$, $p = 0.028$), race of Malay ($t_{(138)} = -1.900$, $p=0.008$), occupation ($F_{(3,66.721)} = 8.819$, $p<0.001$), marital status ($t_{(138)} = -3.116$, p=0.002), and time spent on smartphone ($t_{(133.958)} = -5.830$, $p<0.001$).

Table 5.8: Factors associated with SAS (Overuse) [single factor univariate analysis]

Main factor	SAS (Overuse) Mean (SD)	Mean difference (lower CI, upper CI)	$t_{(df)}/F_{(df1,df2)}$	*p*
MADRS			$t_{(138)}$	0.028
Normal/mild	14.14 (5.00)	-1.869	-2.224	
Moderate/Severe	16.01 (4.79)	(-3.531, -0.208)		
Gender			$t_{(87.597)}$	0.481
Male	15.69 (4.11)	0.593*	0.707*	
Female	15.10 (5.24)	(-1.074, 2.260)		
Race (Chinese)			$t_{(138)}$	0.060
Chinese	14.46 (4.38)	-1.572	-1.900	
Non-Chinese	16.03 (5.33)	(-3.208, 0.064)		
Race (Malay)			$t_{(138)}$	0.008
Malay	16.71 (4.67)	2.268	2.671	
Non-Malay	14.44 (4.93)	(0.589, 3.946)		
Race (Indian)			$t_{(23.682)}$	0.490
Indian	14.38 (6.51)	-1.039	-0.700	
Non-Indian	15.42 (4.62)	(-4.103, 2.025)		
Income			$F_{(3,136)}$	0.805
< 1000	15.38 (4.74)	Reference	0.328	
1001-3000	15.27 (4.72)	0.109 (-3.19, 3.41)		1.000
3001-5000	14.55 (5.20)	0.831 (-2.61, 4.27)		1.000
> 5000	15.70 (5.18)	-0.318 (-3.52, 2.88)		1.000
Education			$t_{(138)}$	0.266
< Degree	14.70 (4.84)	-0.949	-1.118	
≥ Degree	15.65 (5.00)	(-2.627, 0.730)		
Occupation			$F_{(3,66.721)}$	< 0.001
Student	18.16 (3.23)	Reference	8.819$^{\$}$	
Professional	14.21 (4.40)	3.954 (0.680, 7.230)		0.009
Non-professional	14.33 (5.35)	3.828 (0.970, 6.680)		0.030
Unemployed	14.92 (5.21)	3.238 (-0.013, 6.610)		0.067
Marital status			$t_{(138)}$	0.002
Married	13.49 (5.00)	-2.672	-3.116	
Non-married	16.16 (4.68)	(-4.368, -0.976)		

'Table 5.8, Continued'

Main factor	SAS (Overuse) Mean (SD)	Mean difference (lower CI, upper CI)	$t_{(df)}/F_{(df1,df2)}$	*p*
Time spent on smartphone			$t_{(133.958)}$ -5.830*	< 0.001
≤ 6 hours	13.51 (4.82)	-4.319		
> 6 hours	17.82 (3.92)	(-5.784, -2.853)		
Smartphone purpose			$t_{(138)}$ 1.400	0.164
Social media	15.75 (4.88)	1.186		
Non-social media	14.56 (4.98)	(-0.489, 2.860)		

* = Equal variance assumption not met; $ = Welch's robust test of equality means.

Pearson correlation was used because all continuous variables (age, smart-age, SS [significant one, family and friends]) and the outcome variable SAS (overuse) have approximately normal distribution based on skewness and kurtosis examination (values in between -2 to 2). Under the correlation analysis, age of the subjects started to first use smartphone and age of the subjects were negatively associated with SAS "Overuse" subscale with (r = -0.334, p = <0.01) and (r = -0.309, p = < 0.01), respectively (Table 5.9). Noted that age and smart-age exhibited high correlation > 0.9 and VIF = 6.592 > 5. Hence, only smart-age will be included in the analysis of covariance (ANCOVA).

Table 5.9: Continuous variables associated/correlated with smartphone addiction scale (Overuse) [Single variable univariate analysis]

	SAS (Overuse)	Age	Smart-age	SS (SO)	SS (Fam)	SS (Fri)
SAS (Overuse)	1.000	-0.334**	-0.309**	-0.048	-0.045	0.022
Age	-0.334**	1.000	0.921**	0.093	0.248**	-0.038
Smart-age	-0.309**	0.921**	1.000	0.167*	0.268**	0.019
SS (SO)	-0.048	0.093	0.167*	1.000	0.469**	0.501**
SS (Fam)	-0.045	0.248**	0.268**	0.469**	1.000	0.201*
SS (Fri)	0.022	-0.038	0.019	0.501**	0.201*	1.000

Smart-age = age when started to use smartphone; SS = social support; SO = significant one; Fam = family; Fri = friends.
* Pearson correlation coefficient significant at level 0.05 (two-tailed).
** Pearson correlation coefficient significant at level 0.01 (two-tailed).

Analysis of covariance (ANCOVA) revealed participants from different MADRS groups showed no differences in mean of SAS (overuse) after adjusted by the confounders (adjusted mean [lower CI, upper CI] = -0.082 [-1.714, 1.551], p = 0.921) (Table 5.10). Instead, confounder such as the amount of time spent of smartphone remained significantly associated with SAS (overuse) after adjusted by the other variables (MADRS, race, occupation, marital status, smart-age) suggesting this variable was the sole factor contributing to smartphone addiction among the participants. Overall, this model explained a total of 22.4% of variances (adjusted R^2 = 0.224).

Table 5.10 Analysis of covariance (ANCOVA) on multiple factors/variables associated with smartphone addiction scale (overuse)

Main factor	**Mean difference (lower CI, upper CI)**	**Adjusted mean difference (lower CI, upper CI)**	***p***
MADRS			0.921
Normal/mild	-1.869	-0.082	
Moderate/Severe	(-3.531, -0.208)	(-1.714, 1.551)	
Confounders (categorical)	**Mean difference (lower CI, upper CI)**	**Adjusted mean difference (lower CI, upper CI)**	***p***
Race (Malay)			0.192
Malay	2.268	1.097	
Non-Malay	(0.589, 3.946)	(-0.557, 2.750)	
Occupation			0.128
Student	Reference	Reference	
Professional	3.954 (0.680, 7.230)	2.168 (-1.072,5.408)	0.452
Non-professional	3.828 (0.970, 6.680)	2.270 (-0.650, 5.190)	0.236
Unemployed	3.238 (-0.013, 6.610)	0.900 (-2.616, 4.416)	1.000
Marital status			0.819
Married	-2.672	-0.224	
Non-married	(-4.368, -0.976)	(-2.151, 1.703)	
Time spent on smartphone			< 0.001
≤ 6 hours	-4.319	-3.510	
> 6 hours	(-5.784, -2.853)	(-5.112, -1.909)	
Confounder (continuous)	**B (lower CI, upper CI)**	**Adjusted B (lower CI, upper CI)**	***p***
Smart-age	-0.115 (-0.175, -0.056)	-0.038 (-0.112, 0.036)	0.311

B = regression coefficient; CI = confidence interval.
Levene test of equality of error variance = $F_{(43,96)}$ = 1.021, p = 0.456, hence the assumption is met.

Adjusted R^2 = 22.4% of total variances explained by this model

5.6 Factors (socio-demographic and smartphone addiction level) associated with Depression Severity (MADRS)

Spearman ranked correlation was used on the relationship between 'onset' with the MADRS because this variable deviated from the normal distribution (skewness and kurtosis exceeded the range of -2 and 2). Pearson correlation was used on all other continuous variables [SAS all six subscales, age, smart-age, SS (SO), SS (Fm) and SS (Fri)] and the outcome variable MADRS because they were approximately normal distributed based on skewness and kurtosis examinations (values in between -2 to 2). Correlation analysis indicated that there were significant positive correlations between the MADRS scores with SAS subscales such as daily life disturbance (r = 0.168, p = < 0.48), withdrawal (r = 0.187, p = 0.027) and overuse (r = 0.235, p = 0.005). Conversely, the outcome variable had significant negative correlations with age (r = -0.215, p = 0.011), smart-age (r = -0.249, p =0.003), social support (significant one) [r = -0.263, p = 0.002] and social support (family) [r = -0.332, p = < 0.001] (Table 5.11). All these variables were considered in the analysis of covariance (ANCOVA).

Table 5.11 Correlation between the MADRS scores (outcome variable) with smartphone addicted scale (six subscales) [main variables]and other continuous variables (confounders)

	MADRS	SAS (total)	Daily life disturbance	Positive antici-pation	With-drawal	Cyber-space-oriented relationship	Overuse	Tolerance	Age	Onset#	Smart-age	SS (SO)	SS (Fm)	SS (Fri)
MADRS	1.000	0.152	0.168*	-0.088	0.187*	0.149	0.235**	0.107	-0.215*	-0.130	-0.249**	-0.263**	-0.332**	-0.139
SAS (Total)	0.152	1.000	0.625**	0.697**	0.842**	0.778**	0.797**	0.753**	-0.177*	-0.066	-0.023	-0.013	-0.040	0.152
Daily life disturbance	0.168*	0.625**	1.000	0.120	0.426**	0.357**	0.494**	0.607**	-0.178*	-0.160	-0.217*	-0.105	-0.052	-0.170*
Positive anticipation	-0.088	0.697**	0.120	1.000	0.545**	0.451**	0.391**	0.391**	0.011	-0.006	0.067	0.004	-0.023	0.018
Withdrawal	0.187*	0.842**	0.426**	0.545**	1.000	0.608**	0.650**	0.542**	-0.191*	0.004	-0.202*	0.089	-0.021	-0.001
Cyber-space-oriented relationship	0.149	0.778**	0.357**	0.451**	0.608**	1.000	0.533**	0.413**	-0.026	0.056	-0.036	-0.012	0.037	-0.010
Overuse	0.235**	0.797**	0.494**	0.391**	0.650**	0.533**	1.000	0.680**	-0.334**	-0.177*	-0.309**	-0.048	-0.045	0.022
Tolerance	0.107	0.753**	0.607**	0.391**	0.542**	0.413**	0.680**	1.000	-0.207*	-0.116	-0.230**	-0.063	0.059	-0.067
Age	-0.215*	-0.177*	-0.178*	0.011	-0.191*	-0.026	-0.334**	-0.207*	1.000	0.552**	0.921**	0.093	0.248**	-0.038
Onset#	-0.130	-0.066	-0.160	-0.006	0.004	0.056	-0.177*	-0.116	0.522**	1.000	0.493**	0.064	0.192*	-0.065
smart-age	-0.249**	-0.023	-0.217*	0.067	-0.202*	-0.036	-0.309**	-0.230**	0.921**	0.493**	1.000	0.167*	0.268**	0.019
SS (SO)	-0.263**	-0.013	-0.105	0.004	0.089	-0.012	-0.048	-0.063	0.093	0.064	0.167*	1.000	0.469**	0.501**
SS (Fm)	-0.332**	-0.040	-0.052	-0.023	-0.021	0.037	-0.045	0.059	0.248**	0.192*	0.268**	0.469**	1.000	0.201*
SS (Fri)	-0.139	0.152	-0.170*	0.018	-0.001	-0.010	0.022	-0.067	-0.038	-0.065	0.019	0.501**	0.201*	1.000

Smart-age = age when started to use smartphone; SS = social support; SO = significant one; Fm = family; Fri = friend.
* Correlation coefficient significant at level 0.05 (two-tailed);
** Correlation coefficient significant at level 0.01 (two-tailed).

Multicollinearity issue = age and smart-age exhibited high correlation > 0.9 and VIF = 6.592 > 5. Hence, only smart-age will be included in the analysis of covariance (ANCOVA).

Under an univariate analysis (Table 5.12), factors that were significantly associated with the severity of depression (MADRS) were gender ($t_{(138)}$ = -2.703, p = 0.008), marital status ($t_{(77.263)}$ = -3.137, p=0.002), race of Chinese ($t_{(138)}$ = -2.815, p = 0.031), time spent on smartphone ($t_{(138)}$ = -2.403, p=0.018). and the past history of suicidal attempt ($t_{(138)}$ = 2.229, p = 0.027). All variables that were significantly associated with the severity of depression were further analysed using ANCOVA.

Table 5.12: Factors associated with MADRS [single factor univariate analysis]

Factors/ Confounders	MADRS Mean (SD)	Mean difference (lower CI, upper CI)	$t_{(df)}/F_{(df1,df2)}$	*p*
SAS			$t_{(138)}$	0.182
⩽ 98	20.57 (12.52)	-2.772	-1.341	
> 98	23.34 (11.71)	(-6.861, 1.316)		
Gender			$t_{(138)}$	
Male	17.85 (10.72)	-6.025	-2.703	0.008**
Female	23.87 (12.22)	(-10.432, -1.618)		
Race (Chinese)			$t_{(138)}$	0.031*
Chinese	19.93 (11.96)	-4.407	-2.185	
Non-Chinese	24.33 (11.89)	(-8.395, -0.419)		
Race (Malay)			$t_{(138)}$	0.092
Malay	24.47 (11.26)	3.583	1.699	
Non-Malay	20.89 (12.41)	(-0.586, 7.752)		
Race (Indian)			$t_{(138)}$	0.459
Indian	24.00 (13.59)	2.126	0.742	
Non-Indian	21.87 (11.84)	(-3.540, 7.792)		
Income			$F_{(3,136)}$	0.309
< 1000	25.24 (11.99)	Reference	1.208	
1001-3000	23.32 (11.17)	2.025 (-5.980, 10.030)		1.000
3001-5000	20.74 (12.26)	4.499 (-3.840, 12.840)		0.906
> 5000	20.30 (12.09)	4.939 (-2.820, 12.700)		0.544
Education			$t_{(107.355)}$	0.591
< Degree	21.53 (13.26)	-1.124	-0.523#	
≥ Degree	22.65 (11.27)	(-5.383, 3.134)		
Occupation			$F_{(3,67.345)}$	0.320
Student	24.84 (8.98)	Reference	1.189$	
Professional	20.62 (11.02)	4.218 (-4.150,12.590)		1.000
Non-professional	21.02 (13.76)	3.820 (-3.480, 11.120)		0.981
Unemployed	23.23 (12.74)	3.218 (-7.010, 10.220)		1.000
Marital status			$t_{(77.263)}$	
Married	17.53 (13.29)	-7.016	-3.137#	0.002**
Non-married	24.55 (10.76)	(-11.470, -2.563)		
Family history of mental illness			$t_{(138)}$ -0.182	0.856
No	22.29 (12.31)	-0.461		
Yes	21.83 (11.39)	(-5.462, 4.541)		
History of suicide attempt			$t_{(138)}$ 2.229	0.027*
No	21.05 (12.17)	5.541		
Yes	26.59 (10.89)	(0.627, 10.456)		
Medication			$t_{(138)}$	0.880
No	23.00 (14.09)	-0.837	-0.152	
Yes	22.16 (12.07)	(-11.760, 10.086)		
Previous admission			$t_{(138)}$ 1.383	0.169
No	21.50 (12.02)	3.570		
Yes	25.07 (12.18)	(-1.533, 8.673)		

'Table 5.12, Continued'

Factors/ Confounders	MADRS Mean (SD)	Mean difference (lower CI, upper CI)	$t_{(df)}/F_{(df1,df2)}$	0.678
Time spent on smartphone			$t_{(138)}$ -2.403	0.018*
≤ 6 hours	20.19 (12.26)	-4.912		
> 6 hours	25.11 (11.32)	(-8.955, -0.870)		
Smartphone purpose			$t_{(138)}$ 0.284	0.777
Social media	22.43 (12.78)	0.592		
Non-social media	21.84 (11.11)	(-3.533, 4.717)		

SD = standard deviation; CI = confidence interval.
# = Equal variance assumption not met; $ = Welch's robust test of equality means.
* Significant at level 0.05 (two-tailed);
** Significant at level 0.01 (two-tailed).

After adjusting for confounders (gender, race, marital status, history of suicide attempt, time spent on smartphone, age, social support of significant one, social support of family), there were no significant associations between the smartphone addiction subscales [(i) daily life disturbance: adjusted B (lower CI, upper CI) = -0.021 (-0.392, 0.349), p = 0.910; (ii) withdrawal: adjusted B (lower CI, upper CI) = 0.224 (-0.197, 0.645), p = 0.294; (iii) overuse: adjusted B (lower CI, upper CI) = 0.225 (-0.332, 0.782), p = 0.426)] with the MADRS scores.

Confounder such as gender was still significantly associated with MADRS post adjusted by other variables (SAS subscale of "daily life disturbance" "withdrawal" "overuse", race, marital status, history of suicide attempt, time spent on smartphone, age, social support of significant one, social support of family). The analysis revealed that females were generally more depressed compared to males after adjusted by other variables [adjusted mean (lower CI, upper CI): -5.291 (-9.422, -1.160), p =0.012]. Besides that, social support (family) was another confounder that was significantly associated with MADRS after adjusting for other variables (SAS subscale of "daily life disturbance" "withdrawal" "overuse", gender, race, marital status, history of suicide attempt, time spent on smartphone, age, social support of significant one). Participants with high family social support tend to have lower MADRS score [adjusted B (lower CI, upper CI) = -0.349 (-0.681, -0.016), p value = 0.040. Overall, this model explained 21.6% total of variances (adjusted R^2 = 0.216).

Table 5.13: Analysis of covariance (ANCOVA) on multiple factors/variables associated with MADRS

Main Variables	B (lower CI, upper CI)	Adjusted B (lower CI, upper CI)	*p*
SAS-Daily life disturbance	0.347 (0.004, 0.690)	-0.021 (-0.392, 0.349)	0.910
SAS-Withdrawal	0.381 (0.043, 0.718)	0.224 (-0.197, 0.645)	0.294
SAS-Overuse	0.576 (0.176, 0.976)	0.225 (-0.332, 0.782)	0.426
Confounders (categorical)	**Mean difference (lower CI, upper CI)**	**Adjusted mean difference (lower CI, upper CI)**	***p***
Gender			0.012
Male	-6.025	-5.291	
Female	(-10.432, -1.618)	(-9.422, -1.160)	
Race (Chinese)			0.080
Chinese	-4.407	-3.392	
Non-Chinese	(-8.395, -0.419)	(-7.195, 0.410)	
Marital status			0.118
Married	-7.016	-3.867	
Non-married	(-11.470, -2.563	(-8.722, 0.988)	
History of suicide attempt			0.184
No	5.541	3.133	
Yes	(0.627, 10.456)	(-1.506, 7.772)	
Time spent on smartphone			0.475
≤ 6 hours	-4.912	-1.526	
> 6 hours	(-8.955, -0.870)	(-5.736, 2.684)	
Confounders (continuous)	**B (lower CI, upper CI)**	**Adjusted B (lower CI, upper CI)**	***p***
Age	-0.197 (-0.348, -0.046)	0.062 (-0.118, 0.242)	0.495
SS (SO)	-0.480 (-0.777, -0.183)	-0.261 (-0.586, 0.065)	0.116
SS (Fm)	-0.622 (-0.919, -0.324)	-0.349 (-0.681, -0.016)	0.040

B = regression coefficient; CI = confidence interval.
SS = social support; SO = significant one; Fm = family.
Levene test of equality of error variance = $F_{(26,113)}$ = 0.823, p = 0.709, hence the assumption is met.

Adjusted R^2 = 21.6% of total variances explained by this model.

CHAPTER 6

DISCUSSION

6.1 Overview

Usage of smartphones has increased dramatically over the recent years, but its effect on mental health warrants further study. The relationship between smartphone addiction and depression is studied among adolescents and adults in the general population, but none of the published studies on the search engine have addressed this topic on adults who were diagnosed with depression. This study is the first to examine the association of smartphone addiction with depression among depressive patients. It aimed to determine the prevalence, and the socio-demographic and clinical risk factors associated with smartphone addiction. As previous studies have found that the relationship between depression and smartphone addiction is bidirectional, this study also aimed to investigate the relationship between the severity of depression and smartphone addiction.

6.2 Prevalence of Smartphone Addiction Among Depressive Patients

The first objective in this study is to determine the prevalence of smartphone addiction among depressive patients. Previous studies among the general population have reported that the prevalence of smartphone addiction were from as low as 6.3% (Martinotti et al., 2011) to as high as 64.5% (Mazaheri & Najarkolaei, 2014). In this study, the prevalence of patients to be at-risk for smartphone addiction is 58.6%, using the SAS cut-off point of 98 (Ching et al., 2015). The prevalence rate was higher compared to most studies, such as a study done among medical students in Malaysia which showed a lower prevalence rate of 46.8% (Ching et al., 2015). Another study done among the Middle Eastern adult

population using the shorter version of SAS revealed a prevalence of 17% who were probably addicted to smartphone (Alhassan et al., 2018). In Lebanese, using the Mobile Phone Problematic Use Scale (MPPUS-10), the prevalence of problematic smartphone use among adults was also lower at 20.2% (Nahas et al., 2018).

The higher prevalence in this study could be explained by several reasons. Firstly, the smartphone ownership in Malaysia has been on a steady rise as being reported in the Hand Phone Users Survey (HPUS 2017), from 68.7% in 2016 to 75.9% in 2017. Among these respondents, 17.7% owned more than one smartphone (MCMC 2017). With the increase in smartphone ownership, it wouldn't be surprising that the prevalence rate is higher in this study.

Secondly, Malaysians tend to follow the community in their usage of smartphone. They were more likely to purchase a phone not just for its basic function, but to follow the trends in the society to purchase a stylish smartphone, as an indicator of prestige, status, and lifestyle (Osman, Talib, Sanusi, Shiang-Yen, & Alwi, 2012). Furthermore, smartphone allows the usage of social media platforms especially chat apps such as WhatsApp, Facebook messenger, or Telegram which are free for download and usage. This convenience would have encouraged the usage of smartphone for communication purposes.

Thirdly, as the subjects involved in this study are patients who were diagnosed with major depressive disorder, using the smartphone could be one of their ways to cope with the regulation of their negative emotions. With some of them having poor coping strategies,

smartphone could act as a distraction and be a channel for them to disengage from the real world (Elhai, Tiamiyu, et al., 2018). As elevated levels of neuroticism has been associated with increased lifetime risk for major depressive disorder, this study's sample could have more subjects with the personality trait of neuroticism (Xia et al., 2011), compared to the general adult population in other studies. Neuroticism has been linked to smartphone addiction and this could be one of the contributing reasons to a higher prevalence of smartphone addiction in this study (Cocoradă, Maican, Cazan, & Maican, 2018). Furthermore, depression has not only been found to be an independent positive predictor of smartphone addiction (Boumosleh & Jaalouk, 2017), it is also associated with text-message dependency (Lu et al., 2011). Hence, subjects in this study might spend more time using their smartphones resulting in a higher prevalence.

Fourthly, the discrepancy could be related to the different types of assessment scales that were used. The different types of scales that were used in previous studies were such as Smartphone Addiction Scale (Kwon, Lee, et al., 2013), Smartphone Addiction Inventory Scale (Boumosleh & Jaalouk, 2017), Smartphone Addiction Proneness Scale (Y.-J. Kim, Jang, Lee, Lee, & Kim, 2018), Smartphone Use Scale (Elhai & Contractor, 2018), Mobile Phone Use Survey (Zulkefly & Baharudin, 2009) and the Problematic Cellular Phone Use Questionnaire (Long et al., 2016). On top of that, different statistical analyses performed could also affect the prevalence.

Another contributing factor could be the cut-off point of 98 for the SAS that might be too low, resulting in a higher prevalence of smartphone addiction. This cut-off point of 98 was taken from a previous study in Malaysia that was done among medical students, as

there is no recommended cut-off point for the SAS (Ching et al., 2015). Higher cut-off points or different categorization could have been used in other studies resulting in a difference in the prevalence rate.

Lastly, geographical region could contribute to the higher prevalence of smartphone addiction. University Malaya Medical Centre is situated between the border of Kuala Lumpur and Selangor. The population density in Kuala Lumpur is highest in Malaysia (>1501 persons per square km), followed by Selangor which is the second highest in Malaysia (1001 – 1500 persons per square km) (Department of Statistics Malaysia, 2015). The subjects in this study would most probably be staying in these two areas which have the most extensive public transport system available in the country. The number of passengers using public transportation such as the Klang Valley Mass Rapid Transit (MRT) and Light Rail Transit (LRT) has risen over the years (Ministry of Transport Malaysia, 2018). Subjects in this study had more alternative options of traveling besides driving and could be using more of public transport instead of private car. This would have allowed them to have the time and ability to use their smartphones on public transportation, thus contributing to a higher prevalence of smartphone addiction.

However, even though the prevalence rate was higher compared to most countries, the mean SAS score in this study (105.8) was almost similar to another study done among Malaysian undergraduate (mean SAS score = 102.52) (Ithnain et al., 2018). The mean score in this study was in fact slightly lower compared to another study done among South Korea adults (mean SAS score = 110.02) (Kwon, Lee, et al., 2013). This warrants the need for a standard SAS cut-off score to improve the accuracy of the results. The

similarity between the mean SAS score in Malaysia and South Korea could be due to the following reasons. According to the Pew Research Center's statistic on smartphone ownership, Malaysia is one of the countries that has a surge of over 25 percentage points over a period of two years (2013 – 2015), while South Korea emerged as the country with the highest smartphone ownership rate at 88% (Poushter, 2016). A study comparing mobile internet dependency between South Korea and the United States found that regional differences do contribute to smartphone addiction (Shin, 2014), with Korea showing a high dependency of 93.9%, compared to U.S (76.7%). Both Malaysia and Korea are within Asia country region and thus could have similar pattern on the usage of smartphone. With the above reasons, it might explain on why the mean score of both countries are higher compared to other countries.

There are however studies done among college and undergraduate students which showed a lower mean SAS score. A study done in South Korea among college students recorded a mean SAS score of 68.46 (S.-W. Choi et al., 2015), whereas other studies done in Turkey showed mean SAS score of 75.68 and 75.76 (Demirci et al., 2015; Demirci et al., 2014), and another study in India which showed mean SAS score of 85.66 (Soni, Upadhyay, & Jain, 2017). However, since the sample size were obtained from college or undergraduate students and not from depressive adults, the smartphone usage pattern might be different. The smartphone usage of students are found to be affected by various factors such as their fields of study (Oliver, 2005), family income level (Brown, Campbell, & Ling, 2011), and parent education level (Zulkefly & Baharudin, 2009), which could be different from this study's sample population, resulting in a different mean score.

6.3 Association Between Socio-demographic Factors with Smartphone Addiction

The second objective of this study is to determine the association between the socio-demographic risk factors for smartphone addiction among depressive individuals. In this cross-sectional study, both self-rated questionnaires and clinician-rated scales were used to investigate for any significant relationship that existed between the variables. From the data collected, females outnumbered the males. Out of the 140 subjects recruited, there were 101 females. As the samples were collected using convenience sampling, the gender distribution was not equal. Secondly, it could be because women are more likely than male to develop depression (Hopcroft & Bradley, 2007). This is also in accordance with the Malaysia National Health and Morbidity Survey (NHMS) which found that the prevalence of mental health issues among Malaysian women has risen from 11.2% to 12.1% over a period of ten years (NHMS III).

In this study, there is no gender differences found with regards to smartphone addiction. This is supported by a large study done in China among 1062 Chinese undergraduates (Long et al., 2016). Another study among university students revealed the same finding in a developing country (Perry & Lee, 2007). A study done among undergraduate students in Malaysia displayed similar result (Wong, Tho, & Sin, 2016), while oversea studies done among same population did not show gender differences as well (Aker, Sahin, Sezgin, & Oguz, 2017; Hawi & Samaha, 2016). This finding is different from some of the previous studies which have found that there is a difference in gender with regards to smartphone addiction. Most studies done among the general population found that females were more dependent and spent longer time using their smartphones (Demirci et al., 2015; Demirci et al., 2014; Hwang, Yoo, & Cho, 2012; Mok et al., 2014; Nayak, 2018). Females tend to use smartphones for texting, and had a more positive attitude

towards smartphone use in both public and private places (Howell, Love, & Turner, 2008). Besides that, women used more of smartphone to express their emotions (Pawłowska & Potembska, 2011). Another local study among university students also found that females tend to use smartphones for gossip and as a safety device especially when they were out there alone at night (Balakrishnan & Raj, 2012). On the contrary, there were also studies which found the opposite (M.-o. Kim et al., 2015).

There could be a few reasons contributing to the result in this study. Gender differences in smartphone addiction can be affected by cultural reasons and not only because of the functions (Baron & Campbell, 2012). One's culture can influence the user's attitude towards the way they use a mobile phone (J. Choi, Lee, Sajjad, & Lee, 2014). Malaysia being a multi-ethnic and multi-cultural country is quite different from other countries which might just have only one ethnic. Hence, this unique cultural characteristic of our country might influence this study's findings on gender difference on smartphone addiction.

Besides that, statistics obtained from Reuters Institute Digital News Report 2017 reported that 86% of Malaysians turned to the internet as a source of news, with 65% of Malaysians assessing the news through smartphone devices (Newman, Fletcher, Kalogeropoulos, Levy, & Nielsen, 2017). The most frequently used social media platform for news was Facebook (58%), followed by WhatsApp (51%) and YouTube (26%). This is because Malaysians has trust issues with the local media, and hence prefer turning to social media such as The Malaysian Insider for news, which can only be accessible via the internet (Newman et al., 2017). As previous studies have shown that males used more

of the internet while females tend to use more of social media functions, both genders could be equally hooked onto their phones for different purposes. Therefore, based on the findings above, there is no agreement in which gender is more susceptible to smartphone addiction.

Another socio-demographic factor which has been found to be related with smartphone addiction in previous studies is the age factor. Studies showed that smartphone addiction is higher among the younger population (De-Sola Gutiérrez, Rodríguez de Fonseca, & Rubio, 2016; Lopez-Fernandez et al., 2014; Smetaniuk, 2014). One of the possible reasons is because younger individuals have decreased self-control (Bianchi & Phillips, 2005). This characteristic can be found among depressive patients of all ages and not just the younger ones, and this might explain the finding of this study (Özdemir, Kuzucu, & Ak, 2014). Furthermore, there are studies which supported the finding that age is not a predictor for smartphone addiction (Akodu et al., 2018).

Other sociodemographic factors such as race, monthly income, educational level and marital status had no statistically significant correlation with smartphone addiction. This is supported by other studies which showed no association between smartphone addiction and factors such as age, gender, marital status, educational status, occupational status and social class (Aker et al., 2017; Wu et al., 2013). The finding in this study is important as we now know that sociodemographic factors does not affect the smartphone usage level, and hence, all individuals are at risk of developing smartphone addiction. This could ensure better preventive measures to be taken to prevent and reduce smartphone addiction among depressive patients.

Another factor that was commonly found to be a significant predictor of smartphone addiction is the total amount of time spent on using a smartphone (Hong, Chiu, & Huang, 2012). In this study, the total amount of time spent on smartphone every day was significantly associated with smartphone addiction, particularly on the subscale of "Overuse". This is in line with a large study done in China among young adult which found that 56.8% of those who were found to be having smartphone addiction spent more than 6 hours a day using their smartphones (Chen et al., 2016). Another study done in South Korea also showed a positive correlation between the amount of time spent on communication activities with excessive usage of smartphone (J.-H. Kim et al., 2015). There are also other studies which found similar results (Aljomaa et al., 2016; Boumosleh & Jaalouk, 2017; M.-o. Kim et al., 2015; Nayak, 2018; Rozgonjuk, Levine, Hall, & Elhai, 2018). This finding could be explained by several reasons. Depression has been found in many studies to be independently and strongly correlated with addictive behaviors, with one of the most common ones being problematic social media use (Shensa et al., 2017). The respondents in this study could be having problematic social media use, hence spending long hours on the phone each day. Besides that, another study has found that chatting anonymously online not only decreased depression and loneliness, it also increased self-esteem after some time (Shaw & Gant, 2004). This could be a possible reason on why the respondents in this study spent long hours on their smartphones.

6.4 Relationship Between Smartphone Addiction and Severity of Depression

The third objective of this study is to investigate the association between severity of depression and smartphone addiction. To the best of the researcher's knowledge, this is the first study investigating smartphone addiction in individuals with depression. Depression has been known to cause addictive behaviors, and in this case, smartphone addiction (Hwang et al., 2012; Liang et al., 2018). Depressed people were more likely to be addicted to smartphone (M.-o. Kim et al., 2015; Smetaniuk, 2014), and this is further supported by a systematic review which found that depression was consistently related to problematic smartphone use (Elhai, Dvorak, Levine, & Hall, 2017). People who are depressed used smartphones for various reasons such as to relieve their negative feelings (J.-H. Kim et al., 2015) and to avoid social activities (De Silva et al., 2005). On the contrary, there were studies which showed negative association between smartphone addiction and depression. Individuals who had higher depression severity scored lower on the smartphone addiction level (S.-W. Choi et al., 2015; Elhai, Tiamiyu, et al., 2018).

As the relationship between smartphone addiction and depression has been known to be bidirectional, likewise, problematic smartphone usage could also lead to depression (Bickham et al., 2015; Demirci et al., 2015; Jun, 2016). Findings on the association of smartphone addiction with depression is important as it has public health implications, and public awareness could be raised with regards to reduce the potential psychological consequences of smartphone overuse.

In this study, no association was found between severity of depression and smartphone addiction. This finding is not the first, and is supported by other previous studies done

among the general population which showed similar result (Lemola et al., 2015; Mok et al., 2014). The differences between this study's population group and other studies are such that the samples were taken from depressive patients instead of the general population. In the diagnosis of major depressive disorder following the DSM-5, one of the symptoms is poor concentration and forgetfulness. Significant correlations was found between severity of depression and cognitive performance, especially in the domains of episodic memory, processing speed, and executive function, sparing the semantic and visuo-spatial memory (McDermott & Ebmeier, 2009). This could affect the self-reported SAS questionnaire as the respondents could have difficulty recalling their usage of smartphones. On top of that, they could have also experienced difficulties in understanding the questionnaires, resulting in inaccurate reporting of smartphone usage patterns. Moreover, participants could have underestimated their smartphone usage (Cohen & Lemish, 2003), resulting in an inaccurate representation of smartphone addiction.

Furthermore, the SAS was used in this study to assess smartphone addiction. Since the cutoff score for the SAS has not yet been set by the authors (Kwon, Lee, et al., 2013), difficulties were encountered in analyzing the results. If the subjects could be divided into risk groups based on a given cutoff score, it might have generated a different result.

One of the protective factors of depression is spirituality and religiosity (Bonelli, Dew, Koenig, Rosmarin, & Vasegh, 2012). Malaysia is a multiracial country with different races and religions. Over 50% of its people are practicing Islam, alongside other religions such as Christianity, Taoism, Buddhism, Hindus, Sikhs, and other religions by small

number of the community (Nor, 2011). Malaysians who are born into Muslim families are obliged to embrace the Islam religion. This contributes to the high proportion of Malaysians having a religion (99.3%) (Population Distribution, 2010). The involvement of religion or spirituality has been associated with greater life satisfaction, hope, optimism, positive emotions, thus reducing depression and suicidal rates (Bonelli et al., 2012). In a study done among undergraduate students in Malaysia, religion was found to be the only active coping strategy for depression (Mohammed, Shahar, & S Salmiah, 2016). This is also supported by another study done in South Korea which has found that individuals with high levels of depression placed more importance in spiritual values, emphasizing that religion or spirituality is one of the chosen ways to cope with depression (J.-I. Park, Hong, Park, & Cho, 2012). Hence, it could be possible that the respondents in this study had chosen to cope with depression through methods such as religion or spirituality, instead of using their smartphones to alleviate their negative emotions.

Another possible factor that could explain the finding in this study could be the sample population. This study was done among adults instead of younger participants. The median age of this study sample was at 32 years old. Various studies which found a relationship between depression and smartphone addiction were mostly done among students in college and universities (Demirci et al., 2015). A study from Turkey found that younger individuals were more likely to have higher levels of smartphone addiction (Augner & Hacker, 2012). Young adults when faced with high stress level are also more susceptible to smartphone addiction as they may lack positive stress coping mechanism, especially in those with type A personality (N. Park & Lee, 2014). Moreover, adolescents are more ready to accept new technologies (Kwon, Kim, Cho, & Yang, 2013), compared

to the elderly. Hence, the smartphone addiction level may differ when studies are done in adult population.

Besides that, another study has found that smartphone involvement rather than the usage itself was more predictive of depression (Harwood, Dooley, Scott, & Joiner, 2014). The authors explained that the involvement of cognitive and behavioral associations to smartphones were more likely to predict smartphone addiction. The cognitive component of smartphone usage involves thinking and desire to check on the phone to see if something has happened. If an individual is unable to do so, depression can occur. The other component which is the behavioral component is characterized by constant checking on the phone and having the phone in close physical proximity. Hence, individuals with high involvement in smartphones (cognitive and behavioral component) may still be heavily preoccupied with their smartphones even without spending much time on it physically. With regards to this study, there could be a possibility that perhaps depressed patients could still have high involvement with smartphone, but this was not truly reflected on the SAS.

Lastly, having a good self-control and self-management can lower the problematic smartphone use (Jiang & Zhao, 2016). Similar results were found in studies on internet usage (Akın, Arslan, Arslan, Uysal, & Sahranç, 2015), whereby individuals who have higher self-control experienced less problematic internet use (Mei, Yau, Chai, Guo, & Potenza, 2016). The self-control levels in the subjects of this study was not measured. There could be a possibility that some of the participants had good self-control which allowed them to be able to inhibit excessive usage of smartphone.

6.5 Clinical Implications

The findings from this study on the relationship between smartphone addiction and depression severity do have clinical implications. Knowing that severity of depression is not associated with smartphone addiction, all individuals who were diagnosed with major depressive disorder could have the possibility of developing smartphone addiction if they are not cautious with their usage of smartphone. This finding calls for the need for more awareness regarding smartphone usage to be created in hope to reduce the smartphone addiction rate.

Secondly, as there is no association found between depression severity and smartphone addiction, researchers and clinicians may consider with reservation the role of using smartphone applications to aid in the monitoring, treatment, and recovery of one's illness (Cuijpers, Riper, & Andersson, 2015). Using research method such as the Ecological Monetary Assessment (EMA) installed in smartphones or tablets, daily tracking of patient's mood, social interactions, suicidal behaviors, negative thoughts are now more accurate for treatment and research purposes (Armey, Schatten, Haradhvala, & Miller, 2015). Screening of suicide and depression via smartphone application is also possible now, allowing preventive measures to be taken earlier (Jang et al., 2017). Besides that, integrating digital technology via the messaging function in the treatment of depression may also improve communication with patients, resulting in better outcome of illness (Almeida, Almeida, & Figueiredo-Braga, 2018). The potential use of mobile technologies in mental health care can be further explored to maximize its benefits.

6.6 Limitations

All the objectives in this research was answered. However, there are a few limitations that the researchers had encountered during the conduct of this study. Firstly, the sample size of 140 is a small sample size, and is only collected in one of the many centers (UMMC) in Kuala Lumpur. The study population is only depressive patients and the results may not represent the general population. A larger sample would be needed to improve the reliability and validity of the study.

In this study, most of the sample comprised of female gender. One of the reasons could be that the prevalence of depression is higher among females as reported in the National Health Morbidity Survey IV (NHMS IV) 2011 report. Hence, a gender difference error may exist, and the results cannot be generalized due to the inequality in the distribution of gender. Besides that. The socio-demographic data obtained on smartphone use was not detailed enough and other factors contributing to the smartphone addiction could be missed out. Information that was not obtained were such as the types of phone used, the smartphone application that was most used, and the monthly amount of money spent on the smartphone use.

In this study, the smartphone addiction levels were determined based on self-report questionnaires. There could be patients who were reluctant to disclose their smartphone usage pattern and might report lower score in the SAS, providing an inaccurate result. Likewise, there could also be patients who over-report their smartphone usage. Furthermore, the samples were collected using the non-probability sampling method, namely the convenience and purposive sampling method. These methods were used to

aid the researchers in focusing only on depressive patients who own smartphones to answer the research questions. The samples were approached based on the availability and convenience of the researcher's timing, after viewing their medical records. Only those who were found to have been diagnosed with depression was selected. This could lead to bias in selection as the selection was based on the researchers' judgement.

As this study was done using a cross-sectional method, a definitive conclusion could not be drawn. The causal relationship between depression and smartphone use could not be established. Lastly, there can be protective and risk factors in this study's group that is beyond those that were measured. Additional information such as illicit substance use, personality, and functional levels should be obtained in future studies to provide a more accurate result.

6.7 Strengths

Although there were limitations, there are also certain strengths of this study. Firstly, this study is the first study in Malaysia to investigate on smartphone addiction among depressive group of patients. Previous studies have looked into smartphone addiction but mostly were done among students or adults in the general population.

Besides that, this study enabled us to study the possible associations of socio-demographic risk factors with smartphone addiction among patients with major depressive disorder. This will be useful for primary and secondary interventions in the future to be undertaken on prevention of smartphone addiction.

Finally, the instruments that were used in this study were all validated and translated in the local language, which is the Malay language. This will be useful for other clinicians or researches to be able to use the instruments in their future researches or daily practices.

CHAPTER 7

CONCLUSION

7.1 Conclusion

This study to date is the only known documented study done in Malaysia regarding smartphone addiction among depressive patients. The prevalence of smartphone addiction is 58.6%. There is no association of other socio-demographic factors such as age, gender, race, educational level, family income level, occupation, and marital status in smartphone addiction. Amount of time spent on smartphone is positively associated with smartphone addiction. However, the severity of depression is not associated with smartphone addiction.

7.2 Recommendations

In future studies, a longitudinal design method would be more accurate in determining the causal relationship between depression and smartphone addiction. Increasing the sample size would also increase the reliability and external validity of this study. Furthermore, similar study can be expanded to different geographical areas to enable a more accurate representation of the population. Extension of this study to other health care centers would allow a better representative of the Malaysian population. Besides that, equality in gender and races through other sampling methods can be used to obtain an unbiased data. Probability sampling method such as the stratified random sampling method might need to be carried out while recruiting the subjects to reduce bias. More detailed data on protective and risk factors needs to be obtained for further exploration.

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