FACTORS AFFECTING BEHAVIOURAL INTENTION TO USE MOBILE HEALTH APPLICATIONS AMONG OBESE PEOPLE IN MALAYSIA

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ABSTRACT

Obesity is a significant public health issue as it seems to be the cause for high blood pressure, diabetes and other health problems. The human body cannot function efficiently if it has high body mass index score. According to the National Health and Morbidity Survey (NHMS), people with BMI score of ≥ 25 are being categorized as obese. One way to control obesity is to rely on the help of technology such as mobile health applications. In literature, there is a lack in research addressing obese people's intention of using mobile health applications. Recognising the critical role of their behavioural intention to use mobile health applications, this research investigates the factors affecting behavioural intention to use mobile health applications. Adapting Consumer Acceptance Technology (CAT) model by Kulviwat et al. (2007) and Health Belief Model (HBM) developed by Glanz et al. (2008), this research examines factors of perceived cognition, perceived affection, perceived threat, compatibility, accessibility and attitude towards behavioural intention to use mobile health apps. To test the proposed framework, data were collected using quota sampling, while questionnaires were distributed to 500 obese people in the top 5 percent in the states with the obesity population in Malaysia, namely Malacca, Federal Territory of Putrajaya, Negeri Sembilan, Kedah and Perlis. Data collected were analysed using Partial Least Square (PLS) software. The results show that relationship between perceived cognition and perceived affection towards behavioural intention to use is partially significant, while significant relationship has been found between perceived threat, compatibility and accessibility and behavioural intention to use. Besides, perceived cognition and perceived affection partially support relationship on attitude. On the other hand perceived threat, compatibility and accessibility fully support relationship on attitude. Finally, the results demonstrate attitude partially mediates the relationship between perceived cognition and perceived affection, while attitude fully mediates the effect of perceived threat, compatibility, accessibility on behavioural intention to use. Findings provided empirical evidence on the collective effect of behavioural intention to use mobile health applications as well as independent effect of perceived cognition, perceived affection, perceived threat, compatibility and accessibility. Besides, findings suggested to encourage individual to use mobile health applications, while related stakeholders should continually improve user perception on health applications.

KEY WORDS

mobile health applications, obese people, behavioural intention to use, Malaysia

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1 INTRODUCTION

Since 2013, there is a high demand towards mobile health applications. However, statistics showed that the majority of unsatisfied mobile health applications users (58%) were due to several challenges. These include a host of matters, such as interrelated network between applications and hospital systems; health care monitoring by the professionals; mobility concept that enables consumers to do it by themselves (Research2Guidance, 2015); complement the physician-patient interaction particularly after being discharged from hospital; mobile health apps unreachable by those who are under high risk of getting disease (Alushi et al., 2022); privacy concern; lack of trust in government and perceived applications ineffectiveness (Gao et al., 2022) as well as lack of knowledge and benefits of the mobile health applications (Aldhahir et al., 2022).

Zooming into developed country such as the United States, almost 90% of physicians reported that they would suggest mobile health applications to be used by their patients, although only 30% have done so. This matter is primarily because of a lack of knowledge or ability to adequately assess a medical application's quality (Saxon, 2016).

Studies showed that advanced technology such as mobile health applications have a positive outcome for obese people in reducing weight and having a healthy lifestyle (Bakken et al., 2014; Barnett et al., 2015; Kim et al., 2014). In addition, studies showed that using smartphone applications is an efficient tool for weight loss management and behaviour change (Coughlin et al., 2016; Vlahu-Gjorgievska et al., 2018; Bt wan Mohamed Radzi et al., 2020; Arthurs et al., 2022). Therefore, it is undeniable that smartphone applications may help obese people to work for the ideal weight and reduce the risks of the disease.

With reference to Malaysia, the acceptance of mobile health application is at immature level of adoption (Lee et al., 2020). In the market, there are multiple applications available for health and fitness, for example Nike+ Run Club, Fitness for Weight Loss, Mi Fit, Running for Weight Loss and others. Those are applications that may give an opportunity for users to choose the functions that they needed, such as healthy diet and exercise. However, none of them has been specifically developed for obese people. In Malaysia, it is still unclear on utilization rates and the role of the mobile health applications in supporting the health management (Lee et al., 2020).

The Medical Journal of Malaysia reported that there is a gradually increasing percentage of obese people in Malaysia from 4.4% in 1996 to 17.7% in 2015 (Malaysian Medical Association, 2016), and the Indians is the ethnic group with the highest prevalence of the issue (27.7% in 2015). The statistics is rising every year that in 2019, up to 63.9% of Indian adults in Malaysia are overweight or obese (National Institutes of Health, 2019). People can do self-health monitoring and reduce this statistics through the use of mobile health applications. Individuals with obesity are exposed to diabetes, heart attack, high blood pressure and others (Ghee, 2016; Harous et al., 2018; Thorpe et al., 2004). Mobile health applications are the media that enables them to have a healthy lifestyle by self-monitoring system (Lim et al., 2011; Ramanathan et al., 2016).

In Malaysia, there are many studies related to health services (Maarop and Win, 2012; Zailani et al., 2014a, 2014b) and mobile devices services (Blebil et al., 2014; Faziharudean and Li-Ly, 2011; Kuo et al., 2013; Mahat et al., 2012). Unfortunately, there are limited studies which focused on mobile health applications among obese people (Qasim et al., 2015).

Many mobile health applications studies have been performed to promote a healthy lifestyle (Deng et al., 2014; Higgins, 2016; Ramanathan et al., 2016; Subramanian, 2015). However, the issue of low adoption rate and increasing number of people with obesity gives way to anxiety. A large number of prior studies have already examined behavioural intention to use mobile health. For example, a study by Lim et al. (2011) suggested that perceived usefulness and self-efficacy play a key role in predicting the in-

fluence intention to use mobile health. Deng et al. (2014) also indicated that perceived value's behavioural intention to use mobile health services could be influenced. Their study showed a significant effect between perceived value and behavioural intention among middle-aged and older consumers. However, few studies have directly or indirectly examined the relationship among four dimensions of perceived cognition, perceived affection, perceived threat, compatibility, and accessibility towards behavioural intention to use mobile health applications. For example, Dwivedi et al. (2016) discovered that perceived cognition and perceived affection are part of factors in mobile health adoption.

Specifically, the current mixed results and lack of evidence will have practitioners convinced that mobile health applications adoption will improve healthy lifestyles, especially for obese people. However, they did not cover the compatibility and accessibility elements, found to be important as elements to influence obese people to use mobile health applications. Many prior studies have already examined the relationships between perceived cognition and behavioural intention (Alam et al., 2020; Amicelle et al., 2012; Harris et al., 2016; Pai and Alathur, 2019). Meanwhile, it seems rare to find the study related to emotion as in perceived affection. In the well-known theory of Technology Acceptance Model (TAM), Davis (1989) did not cover the emotion part or perceived affection. According to Kulviwat et al. (2007) "the few studies that have incorporated affect have tended to measure a single emotion rather than modelling it comprehensively" (Kulviwat et al., 2007, p. 1059). Results from the review proposed that affection, as pleasure and arousal, can incredibly work on the prescient force of the TAM.

As such, the origin of Consumer Acceptance Technology (CAT) model developed by Kulviwat et al. (2007) showed that the intention to adopt technology and persuade the consumer to accept high-technology innovation is influenced by the cognitive and affective factors. However, researchers such as Chuah et al. (2016) as well as Hall et al. (2015) have taken a step further by using the study's CAT model for wearable technology and social media. The variables used in their research are similar, but slightly different from the current study. In this study, the researcher replicated the Consumer Acceptance Technology (CAT) model with extension of perceived threat, compatibility and accessibility as factors towards attitude and behavioural intention to use mobile health applications. Chuah et al. (2016) as well as Hall et al. (2015) focused on the cognitive and affective variables in their study, but they used different research tool than the study in hand, that is the smartwatch and social media, while the current research used mobile health applications.

Therefore, a more extensive research in this area is required to examine the intention to use mobile health applications, particularly among obese people. Besides, the current study also attended to fulfil the suggestion by Miah et al. (2017) on some issues with the healthcare accessibility. Hence, this study will have accessibility and compatibility as part of the factors towards behavioural intention to use.

The increasing percentage of obese people, theoretical gaps and the insufficient literature specifically on factors influencing behavioural intention to use mobile health applications in Malaysia have indeed captured the researchers' interest. Therefore, in this study, the researchers attempted to investigate the effect of perceived cognition, perceived affection, perceived threat, compatibility, accessibility and attitude towards behavioural intention to use mobile health applications.

2 THEORETICAL BACKGROUND AND RELATED WORK

The innovation of mobile phone is not only limited to the use of networking, but also the applications that have been available to be used for various aspects of health including weight management for obesity (Wang et al., 2017; Castelnuovo et al., 2014; Selvaraj and Sriram, 2022). Past researchers have focused on consumer behavioural intention to use mobile health apps in various health apps across different types of users (Gessa et al., 2020; Palos-Sanchez et al., 2021; Klaver et al., 2021; Schomakers et al., 2022). However, very limited study has been specifically focussed on behaviourial intention to use mobile health apps among obese people. Therefore, this research aims to determine factors that influence obese people's behavioural intention to use mobile health applications.

This research has integrated two underpinning models, namely Consumer Acceptance of Technology Model (CAT) developed by Kulviwat et al. (2007) and Health Belief Model (HBM) developed by Glanz et al. (2008). The integration of CAT Model and HBM were believed to provide new contribution to the existing theory and health informatics discipline. Due to that, the researchers proposed the following framework (Fig. 1).

Fig. 1 is being developed based on the integration of two underpinning theories which are Consumer Acceptance of Technology model (CAT; see Kulviwat et al., 2007) and Health Belief Model (HBM; see Glanz et al., 2008). Fig. 1 represents the proposed framework with independent variables (perceived cognition, perceived affection, perceived threat, compatibility and accessibility); mediating variable (attitude) and dependent variable (behavioural intention to use). The perceived cognition variable comprised three constructs that are perceived ease of use, perceived usefulness and relative advantage. The perceived affection variable comprised three constructs, namely pleasure arousal and dominance, while the perceived threat comprised two constructs, namely per-

ceived susceptibility and perceived severity. The perceived cognition and perceived affection variables are derived from CAT model, while perceived threat is derived from HBM model.

The compatibility and accessibility variables are standalone independent variable without any constructs. These variables, compatibility and accessibility are two important ones that have been highlighted as important variable to be studied in the mobile health applications field, yet inconclusive findings were reported by past researchers, mainly compatibility (Devos et al., 2015; Wu et al., 2011) and accessibility (Miah et al., 2017). Thus, the researchers have included these two variables in the proposed framework above. These two variables, namely compatibility and accessibility are the novelty of the proposed framework (Fig. 1).

2.1 Hypotheses Development

2.1.1 Relationship between Perceived Cognition, Perceived Affection, Perceived Threat, Compatibility and Accessibility towards Behavioural Intention to Use

There is a consensus among social science fields that cognition has been covered by cognition and behavioural intentions to use technology. In Sharifi (2013), there is a positive relationship between cognition and behavioural intention. The result of his study revealed that cognition may influence the behavioural intention to use. Meanwhile, in the past study of Faziharudean and Li-Ly (2011), there is a significant positive influence between perceived ease of use and behavioural intention to use. On the other hand, Zhao et al. (2018) discovered that perceived usefulness and perceived ease of use have a significant effect on individual attitudes and have an influence on behavioural intention. Besides, there is a positive influence on the perceived usefulness and behavioural intention to use in the study of technology devices (Park and del Pobil, 2013) while Pai and Alathur (2019) as well as Wang et al. (2014) found inverse
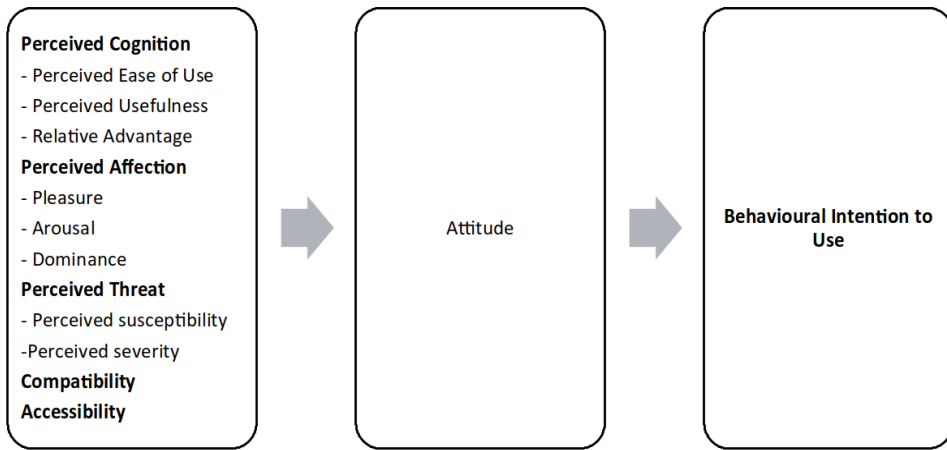
Fig. 1: The Proposed Framework

relationship between perceived usefulness and behavioural intention to use the technology.

In regards to the effect between perceived affection and behavioural intention to use, it was found that there is a positive relationship between cognition and behavioural intention to use. Still, a finding shows the perceived affection factor is more vital to influence behavioural intention (Sharifi, 2013).

Looking at the relationship between perceived threat and behavioural intention to use, the researchers measured perceived threat by looking at the perceived susceptibility and perceived severity (Wei et al., 2021). Past study defines perceived severity of an illness as an individual's assessment of whether the sickness causes harmful behaviour, either clinically or socially (Deng, 2013). If people are more vulnerable to health, they might consider utilising mobile health applications as a preventive step for health (Saunders et al., 2013).

In addition, past findings demonstrated that the perceived severity of disease had a significant effect on attitude, which significantly affects behavioural intention to utilise mobile health (Zhang et al., 2019; Karahoca et al., 2018). If a person understands their continuous poor behaviour, the suggested response is more likely to be taken to themselves (Lee and Chang, 2011). This matches earlier studies, which found that mobile health applications

greatly impacted, especially on physical well-being. In line with previous research done in China, which discovered that individuals who see a bigger danger are also more likely to feel that fitness programmes are more beneficial.

In regards to the relationship between compatibility and behavioural intention to use, Ndayizigamiye and Maharaj (2017) examined the compatibility elements that influence the adoption of mobile health among healthcare professionals in East Africa. The majority of healthcare professionals agreed that to run everyday activities, compatibility of mobile health is required. The compatibility of mobile health helps them to perform their duty and organise their working style. The findings is also supported by research conducted by Meri et al. (2019), which found that compatibility is significant towards behavioural intentions in examining the cloud health information system. However, it does the opposite from the study by Shareef et al. (2014), that compatibility does not become significant with behavioural intention. Hence, through the study on the Internet of Things in health care, they found that the relationship between compatibility and behavioural intention does not support it (Karahoca et al., 2018).

In viewing the effect of accessibility towards behavioral intention to use, accessibility refers to access or entry into the health care applica-

tion (Aday and Andersen, 1974). In the work of Ye et al. (2019), the perspective of mobile health in China was found that the implementation of mobile health had a substantial influence on accessibility. Moreover, Pai and Alathur (2021) investigated the use of mobile phone-based healthcare solutions during the Covid-19 pandemic, and discovered that a lack of awareness, accessibility and an unwillingness to utilise the technology, complicated healthcare demands, application infrastructure, policies, and a lack of training and support impedes the successful use of this important tool. This has demonstrated that with public knowledge, accessibility, and acknowledgement of healthcare requirements, mobile health innovation is the solution to support a healthy lifestyle. Overcoming the difficulties such as accessibility of mobile health applications may encourage users to adopt mobile health applications and improve the response towards the coronavirus pandemic. Thus, the following hypothesis was formulated:

Hypothesis 1. Perceived cognition, perceived affection, perceived threat, compatibility and accessibility have significant positive effect on behavioural intention to use.

2.1.2 Relationship between Perceived Cognition, Perceived Affection, Perceived Threat, Compatibility and Accessibility towards Attitude

Looking at the relationship between perceived cognition and attitude, an individual believes a technology product or system tends to be more useful if it is easy to use and requires minimal effort (Davis, 1989; Davis and Venkatesh, 2004). In addition, in the study on technology adoption by Alsaleh and Thakur (2019), there is a significant relationship between perceived usefulness and attrition.

In regards to the relationship between perceived affection and attitude, in many countries throughout the world, the substantial effect of pleasure has been discovered on adopting high technology solutions (Hall et al., 2015; Huang et al., 2017; Kulviwat et al., 2007). Therefore, people worldwide with pleasure and joy utilisese new technology are likely to accept technology more positively than those with less pleasant affection. Next, in determining the success of

domination, Kulviwat et al. (2007) and Nasco et al. (2008) discovered insignificant findings between dominance and technological acceptance. In another study, Alsaleh and Thakur (2019) reported that all pleasure, arousal and dominance are significant towards attitude.

With regard to the relationship between perceived threat and attitude, the health belief model introduced perceived threat with the elements of perceived susceptibility and perceived severity (Becker, 1974). Based on health behaviour theory, perceived susceptibility and perceived severity substantially influences attitude and emphasises the impact of threat assessments (Zhao et al., 2018). To some extent, the results appear to support the notion that the more seriously individuals regard their illnesses, the more likely they are to engage positively with the mobile health application (Zhang et al., 2019). The findings of their study found that there is a positive relationship between perceived severity and attitude. It shows that if people feel they have a more serious health risk, mobile health is more likely to be used as a precautionary for a health condition. In other words, it means perceived threat positively influences the attitude to use mobile health applications.

In terms of relationship between perceived compatibility and attitude, compatibility which is the degree to which innovation is perceived to be consistent with potential users' existing values, prior to experiences and needs (Rogers, 2003); it is one of the challenges or barriers that developers face to ensure the applications fulfil the consumer's requirements (Ahmad et al., 2018). They emphasised that the lack of tool support renders the applications incompatible and results in a failure in mobile application development. A study by Ndayizigamiye and Maharaj (2017) showed that compatibility is one element that influences them to use mobile health applications. Furthermore, attitude has the most impact on adopting any Internet of Things healthcare device and is the factor used to explain adoption intentions (Karahoca et al., 2018). In addition, another study shows compatibility is positively significant towards the attitude (Meri et al., 2019). Under such circum-

stances, mobile health applications may help to promote positive attitudes by performing specific roles among obese people in Malaysia.

In regards to the relationship between accessibility and attitude, even though there is no specific research in the context of mobile technology acceptance that referred direct relationship between accessibility and attitude (Harous et al., 2018; Lyzwinski et al., 2017), the latter agreed that one of the perceived benefits is the accessibility of mobile health applications, which could be shaping habits and behaviour. Harous et al. (2018) supported the study that accessibility of mobile health applications could influence the user to have and maintain a healthy lifestyle. Given this, it is further hypothesized that:

Hypothesis 2. Perceived cognition, perceived affection, perceived threat, compatibility, accessibility have significant positive effect on attitude.

2.1.3　Relationship between Attitude and Behavioural Intention to Use

In this research, the dependent variable is behavioural intention to use, being defined as a measure of an individual's likelihood of the behaviour indicated (Fishbein and Ajzen, 1975). While the attitude was positive, the consumer thought towards performing the target behaviour can be either positive or negative (Kulviwat et al., 2007). In the context of consumers, Kulviwat et al. (2007) highlighted that the attitude towards the intention to adopt technological advancement is completely mediated by social influence.

Hussein et al. (2017) discovered that attitude is associated with the intention to use mobile health. Moreover, there is a positive relationship between attitude and behavioural intention (Karahoca et al., 2018) in the adoption of healthcare product. In reviewing the conceptual work of Alsaleh and Thakur (2019), the structural model supported the hypothesis that attitude towards adopting an innovative technology was significantly related to the intention to use that technology. Therefore, the following hypothesis was formulated:

Hypothesis 3. Attitude has significant positive effect on behavioural intention to use.

2.1.4　The Mediation Effect between Attitude, Perceived Cognition, Perceived Affect, Perceived Threat, Compatibility, Accessibility and Behavioural Intention to Use

The perceived cognition variable (which is represented by the constructs of perceived usefulness, perceived ease of use and relative advantage) has been found in several prior studies. There is a significant positive relationship that has been found between the perceived usefulness of new Internet services and attitudes towards these services (Childers et al., 2001; Gentry and Calantone, 2002; Karahoca et al., 2018). Similarly, perceived usefulness has been found to have a positive impact on attitude towards using mobile Internet products (Bruner and Kumar, 2005; Lee et al., 2003; Kulviwat et al., 2007). Similarly, ease of use was found to have a direct and positive effect on attitude towards use of technological innovations (Childers et al., 2001; Dabholkar and Bagozzi, 2002; Gentry and Calantone, 2002; Karahoca et al., 2018). However, not all advantages are necessarily considered useful by consumers. Hence, usefulness partially mediates the effect of relative advantage on attitude towards adoption (Kulviwat et al., 2007).

The variable of perceived effect (pleasure, arousal and dominance), has also shown the positive effect on attitude and towards the adoption of technology. Besides, when operationalized as fun, it had a direct effect on attitude towards the use of handheld internet devices (Bruner and Kumar, 2005). Moreover, Igbaria and Parasuraman (1989) found that anxiety was the strongest predictor of negative attitude towards technology. In fact, the effect was even greater than that of the demographic and cognitive style variables examined (Kulviwat et al., 2007).

The variable of perceived threat (the constructs of perceived susceptibility and perceived severity) from the health belief model (Becker, 1974); would determine the positive effects on attitude towards using mobile health application. To some extent, the result seems to confirm with the statement that the more seriously people perceive the diseases, the more likely

they are to have positive engagement (Zhang et al., 2019) with mobile health applications.

In this study, the compatibility and accessibility variables (Fig. 1) were seen as a contribution to the integration of two models, namely Consumer Acceptance of Technology Model and Health Belief Model. The significance of

accessibility and attitude variables has been shown by Ndayizigamiye and Maharaj (2017); Harous et al. (2018) and Lyzwinski et al. (2017).

Hypothesis 4. Attitude mediates relationship between perceived cognition, perceived affection, perceived threat, compatibility, accessibility and behavioural intention to use.

3   MATERIALS AND METHODS

Respondents were selected based on the following criteria, namely individual aged 18 and above (The National Health and Morbidity Survey, NHMS), owner of at least a smartphone, obese people with an obesity score of $\geq$ 25 (according to Asia Pacific guideline) on their body mass index (BMI). The selection of sample based on quota sampling was being exercised based on the five states in Malaysia with the highest number of obese people. The NHMS (Institute for Public Health, 2015) reported the highest percentage of states with obesity were Federal Territory of Putrajaya (43.0%), Malacca (36.0%), Perlis (36.0%), Negeri Sembilan (35.6%) and Kedah (33.2%).

Referring to the sample size, the researchers have chosen the Cohen (1988) formula as guidance on sample size for this research. The allocation of sample size for this study is depicted in Tab. 1.

Tab. 1: Total distribution of questionnaire across selected state

State	Total Distribution of Questionnaire
Federal Territory of Putrajaya	10
Malacca	105
Perlis	5
Negeri Sembilan	145
Kedah	235
Total	500

This study used survey as a tool to measure the data collected for the study. The structure of the questionnaire is shown in Tab. 2.

Tab. 2: Structure of questionnaire

Variable Name	Source
Perceived ease of use	Chuah et al. (2016); Kulviwat et al. (2007)
Perceived usefulness	Chuah et al. (2016); Kulviwat et al. (2007)
Relative advantage	Chuah et al. (2016); Kulviwat et al. (2007)
Pleasure	Chuah et al. (2016); Kulviwat et al. (2007)
Arousal	Chuah et al. (2016); Kulviwat et al. (2007)
Dominance	Chuah et al. (2016); Kulviwat et al. (2007)
Perceived susceptibility	Kim et al. (2012); Saunders et al. (2013)
Perceived severity	Kim et al. (2012); Saunders et al. (2013)
Compatibility	Atkinson (2007); Kim et al. (2010)
Accessibility	Hsu and Liao (2014)
Attitude	Chuah et al. (2016); Kulviwat et al. (2007)
Behavioural intention to use	Chuah et al. (2016); Kulviwat et al. (2007)

3.1   Ethical Approval

The study protocol was reviewed and approved by the Research Management Centre (RMC), Universiti Teknologi MARA (UiTM) with clearance number 600-IRMI (5/1/6). In addition, the permission to carry out data collection was granted by the National Medical Research Register (NMRR) Malaysia. This ethical consideration is used to safeguard the respondent's privacy. Each respondent must sign a consent form granting permission to conduct the survey and publish the results. The data can be used for this study after they have signed the consent form.

4 RESULTS

The first section of this research results deliberates on the profiling background of the respondents, while the second section discusses the major findings of hypotheses testing. Out of the 500 questionnaires distributed, 114 questionnaires were discarded due to either not returned or contained incomplete information (missing item). Thus, 386 questionnaires were further used and analysed for this research. Several reasons might explain the probability of not returning the questionnaires and missing items. In this study, the respondents were from the sensitive group of obesity and some of them were probably unaware of the importance of the research. Others might have felt threatened despite a brief explanation and ethical consideration consent was given.

4.1 Demographic Profile of Respondents

In the first section, namely profiling background of the respondents, as depicted in Tab. 3, it

was found that majority of them are female counted at 227 (58.8%), between 30–39 years of age at 176 (45.6%). Besides, in relation to mobile health applications, majority of the respondents used mobile apps at least once in a week, accounted for 76 respondents (19.7%) and 339 respondents (87.8%) were aware that information can be accessed via mobile health applications.

4.2 Measurement Model

Overall, the composite reliability for every construct used in this research was high with values of 0.9 and above. All the indicators for behavioural intention to use demonstrated the highest value (0.974), followed by perceived usefulness (0.973). Other constructs also had a substantial amount in construct reliability. The details of each composite reliability are in Tab. 4. Besides, all constructs in this study achieved an average variance extracted (AVE) value higher than 0.5. The amount showed that

Tab. 3: Respondents' Demographic

		Frequency ($n = 386$)	Percent (%)
Gender	Male	159	41.2
	Female	227	58.8
Age	19–29	101	26.2
	30–39	176	45.6
	40–49	78	20.2
	50–59	30	7.8
	60 and above	1	0.3
Frequency using mobile health applications	Less than once in a week	71	18.6
	At least once in a week	76	19.7
	Three or four times in a week	56	13.2
	At least once a day	24	6.2
	Several times a day	8	2.1
	All-day long	6	1.6
	Never	150	38.9
Awareness health care information can be accessed via applications	Yes	339	87.8
	No	30	7.8
	Unknown	17	4.4

all the constructs used in this study met the standard of minimum convergent validity (Hair et al., 2016; Henseler et al., 2016). However, one item with loading below 0.7 value which is PSUS1 (0.528) was found; the researcher decided that such item should remain since the value was within 0.4 and 0.7.

Additionally, the convergent validity for the construct of perceived susceptibility was above 0.05 and it is valid to be used in the study (Hair et al., 2016). Tab. 4 shows the confirmatory factor analysis model which shows the assessment of internal consistency and convergent validity for the construct of perceived ease of use, perceived usefulness, relative advantage, pleasure, arousal, dominance, perceived susceptibility, perceived severity, compatibility, accessibility and attitude as the mediate variable and behavioural intention to use as the dependent variable.

Besides the confirmatory factor analysis model above, the discriminant validity test was conducted to ensure each construct is distinct from the other (Hair et al., 2016). Discriminant validity based on Heterotrait-Monotrait (HTMT) test (Hair et al., 2016; Henseler et al., 2016) was used which is obtainable in the PLS Algorithm procedure. The purpose of HTMT test is to ensure all the indicators are different from each other (Hair et al., 2016). Several authors have emphasised the measurement of HTMT value (Clark and Watson, 1995; Kline, 2015a) should be either below 0.85 or 0.9 (Clark and Watson, 1995; Gold et al., 2001; Kline, 2015b; Teo et al., 2008). These recommendations were reported to produce the best value, with high sensitivity for the validation value among every single indicator. However, Henseler et al. (2016) stated that when the HTMT value is less than 1, it is acceptable to show that the indicators are distinct from each other.

Tab. 5 represents the HTMT values of this study obtained from the procedure of the PLS Algorithm. The value of HTMT of each indicator was below 0.9. This situation indicates that all indicators of this study met the established discriminant validity standard value of HTMT.

4.3 Hypotheses Testing

Hypothesis 1. Perceived cognition, perceived affection, perceived threat, compatibility and accessibility has significant positive effect on behavioural intention to use.

Tab. 6 illustrates the hypothesis testing for hypothesis 1 that is perceived cognition, perceived affection, perceived threat, compatibility and accessibility have significant positive effect on behavioural intention to use. The results show that hypothesis 1 is partially supported. There are two elements which did not support relationship in this study. These elements are perceived usefulness and arousal that are not significant towards behavioural intention to use mobile health applications, while other elements are fully supported.

Hypothesis 2. Perceived cognition, perceived affection, perceived threat, compatibility, accessibility has significant positive effect on attitude.

As depicted in Tab. 7, based on the results, there are significant relationship between perceived ease of use (H_{2a}), relative advantage (H_{2c}), pleasure (H_{2d}), dominance (H_{2f}), perceived susceptibility (H_{2g}), perceived severity (H_{2h}), compatibility (H_{2i}) and accessibility (H_{2j}). However, this study also found that the relationship was insignificant between perceived usefulness and attitude (H_{2b}) and the relationship between arousal and attitude (H_{2e}).

Hypothesis 3. Attitude has significant positive effect on behavioural intention to use.

As shown in Tab. 8, the result revealed that attitude has a significant positive relationship with the behavioural intention to use (H_3). To some extent, the result seems to conform with the principle of CAT model, which highlights the attitude as playing a mediator role in the model (Kulviwat et al., 2007). This not only in CAT model, but also in several other theories and models, for instance, TAM (Davis, 1989), TRA (Fishbein and Ajzen, 1975) and others.

Hypothesis 4. Attitude mediate relationship between perceived cognition, perceived affection, perceived threat, compatibility, accessibility and behavioural intention to use.

Tab. 4: Confirmatory factor analysis model

Construct	Item	Loading	Composite Reliability (CR)	Average Variance Extracted (AVE)	Convergent Validity (AVE > 0.5)
Perceived Ease of Use	PEOU1	0.715	0.957	0.820	Yes
	PEOU2	0.953			
	PEOU3	0.976			
	PEOU4	0.913			
	PEOU5	0.947			
Perceived Usefulness	PU1	0.867	0.973	0.877	Yes
	PU2	0.927			
	PU3	0.923			
	PU4	0.975			
	PU5	0.987			
Relative Advantage	RA1	0.891	0.957	0.817	Yes
	RA2	0.903			
	RA3	0.941			
	RA4	0.901			
	RA5	0.881			
Pleasure	PL1	0.844	0.941	0.799	Yes
	PL2	0.875			
	PL3	0.886			
	PL4	0.967			
Arousal	AR1	0.778	0.947	0.818	Yes
	AR2	0.933			
	AR3	0.955			
	AR4	0.941			
Dominance	DO1	0.953	0.961	0.860	Yes
	DO2	0.968			
	DO3	0.961			
	DO4	0.819			
Perceived Susceptibility	PSUS1	0.528	0.952	0.807	Yes
	PSUS2	1.097			
	PSUS3	0.928			
	PSUS4	0.930			
	PSUS5	0.910			
Perceived Severity	PSEV1	0.809	0.928	0.764	Yes
	PSEV2	0.873			
	PSEV3	0.819			
	PSEV4	0.985			
Compatibility	COMP1	0.902	0.970	0.889	Yes
	COMP2	0.939			
	COMP3	0.967			
	COMP4	0.961			
Accessibility	ACC1	0.752	0.960	0.829	Yes
	ACC2	0.919			
	ACC3	0.889			
	ACC4	1.006			
	ACC5	0.967			
Attitude	ATT1	0.843	0.960	0.826	Yes
	ATT2	0.828			
	ATT3	0.951			
	ATT4	0.978			
	ATT5	0.934			
Behavioural Intention to Use	BI1	0.885	0.974	0.884	Yes
	BI2	0.955			
	BI3	0.981			
	BI4	0.908			
	BI5	0.969			

Note: Perceived Ease of Use (PEOU), Perceived Usefulness (PU), Relative Advantage (RA), Pleasure (PL), Arousal (AR), Dominance (DO), Perceived Susceptibility (PSUS), Perceived Severity (PSEV), Compatibility (COMP), Accessibility (ACC), Behavioural Intention to Use (BI) and Attitude (ATT) as mediator.

Tab. 5: Heterotrait-Monotrait (HTMT)

	PEOU	PU	RA	PL	AR	DO	PSUS	PSEV	COMP	ACC	ATT	BI
PEOU	–											
PU	0.698	–										
RA	0.702	0.799	–									
PL	0.530	0.554	0.649	–								
AR	0.535	0.566	0.572	0.749	–							
DO	0.552	0.560	0.589	0.610	0.668	–						
PSUS	0.223	0.226	0.317	0.319	0.167	0.169	–					
PSEV	0.146	0.122	0.240	0.204	0.257	0.197	0.239	–				
COMP	0.466	0.461	0.486	0.471	0.453	0.468	0.269	0.243	–			
ACC	0.527	0.517	0.610	0.476	0.453	0.459	0.262	0.194	0.674	–		
ATT	0.474	0.477	0.521	0.428	0.409	0.398	0.212	0.317	0.468	0.611	–	
BI	0.405	0.472	0.512	0.468	0.447	0.419	0.230	0.335	0.507	0.623	0.826	–

Note: Perceived Ease of Use (PEOU), Perceived Usefulness (PU), Relative Advantage (RA), Pleasure (PL), Arousal (AR), Dominance (DO), Perceived Susceptibility (PSUS), Perceived Severity (PSEV), Compatibility (COMP), Accessibility (ACC), Behavioural Intention to Use (BI) and Attitude (ATT) as mediator.

Tab. 6: Path Coefficient Assessment between Perceived Cognition, Perceived Affection, Perceived Threat, Compatibility, Accessibility and Behavioural Intention to Use

Hypothesis	Relationship	Std. Beta	Std. Error	T-Value	Decision
H_{1a}	PEOU → BI	0.147	0.065	2.238*	Supported
H_{1b}	PU → BI	0.075	0.066	1.141	Not Supported
H_{1c}	RA → BI	0.241	0.071	3.393**	Supported
H_{1d}	PL → BI	0.176	0.062	2.815**	Supported
H_{1e}	AR → BI	0.090	0.069	1.293	Not Supported
H_{1f}	DO → BI	0.135	0.051	2.647**	Supported
H_{1g}	PSUS → BI	0.120	0.048	2.513*	Supported
H_{1h}	PSEV → BI	0.222	0.043	5.209**	Supported
H_{1i}	COMP → BI	0.357	0.045	7.936**	Supported
H_{1j}	ACC → BI	0.436	0.057	7.650**	Supported

Notes: ** $p < 0.01$, * $p < 0.05$. Perceived Ease of Use (PEOU), Perceived Usefulness (PU), Relative Advantage (RA), Pleasure (PL), Arousal (AR), Dominance (DO), Perceived Susceptibility (PSUS), Perceived Severity (PSEV), Compatibility (COMP), Accessibility (ACC), Attitude (ATT) and Behavioural Intention to Use (BI)

The result in Tab. 9 showed the mediation result that were formulated via bootstrapping analysis using the Smart-PLS software. Majority of the indicators of hypotheses shows the result as expected, except for the hypothesis H_{4c} (RA → ATT → BI) and hypothesis H_{4e} (AR → ATT → BI) which were not supported. Besides, another important analysis which are important in this study were assessing the level of R-square (R^2), f-square (f^2), effect size and predictive relevance (Q^2).

Tab. 10 shows that the R-square for mediating variable (attitude) and dependent vari-

able (behavioural intention to use) was 0.456 and 0.730, respectively. Thus, it shows that the results were exogenous constructs which explained 73.7% of the total variance in behavioural intention to use mobile health applications. In addition, in Tab. 8 the outcome of predictive relevance Q^2 shows the attitude with 0.362 while behavioural intention to use was 0.621. The result was higher than 0.000, thus it indicated that exogenous construct has predictive relevance over endogenous construct.

Tab. 7: Path Coefficient Assessment between Perceived Cognition, Perceived Affection, Perceived Threat, Compatibility, Accessibility and Attitude

Hypothesis	Relationship	Std. Beta	Std. Error	T-Value	Decision
H_{2a}	PEOU → ATT	0.189	0.084	2.257*	Supported
H_{2b}	PU → ATT	0.097	0.088	1.098	Not Supported
H_{2c}	RA → ATT	0.310	0.093	3.325**	Supported
H_{2d}	PL → ATT	0.232	0.089	2.605**	Supported
H_{2e}	AR → ATT	0.118	0.103	1.152	Not Supported
H_{2f}	DO → ATT	0.178	0.063	2.823**	Supported
H_{2g}	PSUS → ATT	0.151	0.062	2.440*	Supported
H_{2h}	PSEV → ATT	0.279	0.056	5.008**	Supported
H_{2i}	COMP → ATT	0.471	0.051	9.282**	Supported
H_{2j}	ACC → ATT	0.612	0.054	11.317**	Supported

Notes: ** $p < 0.01$, * $p < 0.05$. Perceived Ease of Use (PEOU), Perceived Usefulness (PU), Relative Advantage (RA), Pleasure (PL), Arousal (AR), Dominance (DO), Perceived Susceptibility (PSUS), Perceived Severity (PSEV), Compatibility (COMP), Accessibility (ACC), Attitude (ATT) and Behavioural Intention to Use (BI)

Tab. 8: Path Coefficient Assessment between Attitude and Behavioural Intention to Use

Hypothesis	Relationship	Std. Beta	Std. Error	T-Value	Decision
H_3	ATT → BI	0.675	0.069	9.771**	Supported

Notes: ** $p < 0.01$, * $p < 0.05$. Perceived Ease of Use (PEOU), Perceived Usefulness (PU), Relative Advantage (RA), Pleasure (PL), Arousal (AR), Dominance (DO), Perceived Susceptibility (PSUS), Perceived Severity (PSEV), Compatibility (COMP), Accessibility (ACC), Attitude (ATT) and Behavioural Intention to Use (BI)

Tab. 9: Mediation Effects using the Bootstrapping Analysis

Hypothesis	Relationship	Std. Beta	Std. Error	T-Value	Decision
H_{4a}	PEOU → ATT → BI	0.241	0.073	3.294**	Supported
H_{4b}	PU → ATT → BI	0.147	0.064	2.284*	Supported
H_{4c}	RA → ATT → BI	0.075	0.071	1.054	Not Supported
H_{4d}	PL → ATT → BI	0.176	0.068	2.601**	Supported
H_{4e}	AR → ATT → BI	0.090	0.078	1.155	Not Supported
H_{4f}	DO → ATT → BI	0.135	0.049	2.755**	Supported
H_{4g}	PSUS → ATT → BI	0.222	0.043	5.209**	Supported
H_{4h}	PSEV → ATT → BI	0.120	0.048	2.513*	Supported
H_{4i}	COMP → ATT → BI	0.357	0.045	7.936**	Supported
H_{4j}	ACC → ATT → BI	0.436	0.057	7.650**	Supported

Notes: ** $p < 0.01$, * $p < 0.05$. Perceived Ease of Use (PEOU), Perceived Usefulness (PU), Relative Advantage (RA), Pleasure (PL), Arousal (AR), Dominance (DO), Perceived Susceptibility (PSUS), Perceived Severity (PSEV), Compatibility (COMP), Accessibility (ACC), Attitude (ATT) and Behavioural Intention to Use (BI)

Tab. 10: Strength of the Mediating and Dependent Effect based on Cohen's (1988) and Henseler et al. (2016) Guidelines

Construct	R-Square (R^2)		f-Square (f^2)	Effect Size	Predictive Relevance (Q^2)
	Included	Excluded			
Attitude	0.456	0.442	0.918	Large	0.362
Behavioural Intention to Use	0.730	0.722	–	–	0.621

Notes: For interpretation of R^2, 0.75 is substantial, 0.50 is moderate, and 0.25 is weak. For interpretation of effect size, 0.02 and above – small effect size, 0.15 and above – medium and 0.35 and above as large effect (Cohen, 1988; Hair et al, 2014). For interpretation of Q^2, a value larger than 0 indicate the exogenous construct has predictive relevance over endogenous construct.

5 DISCUSSION

Hypothesis 1. Perceived cognition, perceived affection, perceived threat, compatibility and accessibility has significant positive effect on behavioural intention to use.

The findings indicated that perceived ease of use have significant effect towards behavioural intention to use mobile health apps, thus supported hypothesis H_{1a}. This findings are in line with past studies of Faziharudean and Li-Ly (2011) and Zhao et al. (2018).

Interestingly, this study identified that the direct effect of perceived usefulness and behavioural intention to use (H1b) was insignificant and these are in line with the work of (Karahoca et al., 2018; Pai and Alathur, 2019; Wang et al., 2014). However, these findings contradict with the study of Park and del Pobil (2013) and Alsaleh and Thakur (2019) on technology innovation, showed a positive relationship between perceived usefulness and behavioural intention to use. This outcome indicates that when it comes to behavioural intention to use mobile health applications, healthcare practitioner plays a more important role than perceived usefulness. Traditionally, only the care that takes place in the physical clinic or hospital is required by the health provider. However, today they must take care of patients within the hospital and their patients who use their services online (Alweshail and Brahim, 2020). With the help of mobile health applications, the health care practitioners could trace the patients' health background and the assessment they undergo. For instance, relating to the issues of the Covid-19 pandemic, mobile health applications help health workers to trace individual assessments quickly (Wei et al., 2021). The mobile health applications provided the patients' background and encouraged communication among healthcare workers (Hussein, 2018; Alweshail and Brahim, 2020).

The reason behind this is due to a digital solution which has been recommended by the professionals (Pai and Alathur, 2019), whereby the specification and requirement are preferably developed based on their own preferences.

Therefore, the mutual understanding between patient or users and health practitioners are needed, and for the public, they need guidance on ways to use it. For example, when the software developer understands the challenges and issues that the patients and health care workers are facing in adopting to the use of the mobile health applications, they could provide the most appropriate solutions in applications that are suitable to meet their consumers' needs to implement the mobile health applications successfully (Hoque and Sorwar, 2017).

As noted earlier, the result indicated that hypothesis relative advantage (H_{1c}) have a significant effect towards behavioural intention to use. From the data analysis, there was a significant positive relationship between relative advantage and behavioural intention to use, which is parallel with the study by Butcher et al. (2012). Hence, it shows that the majority of obese people who are exposed to mobile health applications believe that the application would be beneficial to their everyday lives. For example, the advancements in mobile health applications would allow patients, or consumers like obese people, to access their medical health information quicker than ever before (Balapour et al., 2019; Chen et al., 2018; Choi et al., 2020; Naddeo et al., 2017). In the case of an emergency, consumers or obese people often need immediate help. They can use the mobile health applications to learn or seek information. Additionally, smartphone-compatible healthcare applications might aid in facilitating consumers' continuous healthcare, as it can be monitored remotely (Balapour et al., 2019; Chen et al., 2018; Choi et al., 2020; Naddeo et al., 2017).

In addition, it makes it easy to track their symptoms and the effectiveness of the medications if the individuals are on a prescribed or pharmaceutical therapy. Individuals who have to regulate their non-communicable diseases should also have regular self-monitoring. Non-communicable illnesses (hypertension, obesity, anaemia, dengue, handicapped) are diseases that cannot be

transmitted by traditional means of infection. A report by the Ministry of Health Malaysia, non-communicable diseases, risk factors and other health problems have been monitored periodically. In other words, it is advised that an individual with a non-communicable disease, like obesity and being overweight, should utilise mobile health applications. Dounavi and Tsoumani (2019) have agreed that individuals who self-monitored using mobile health applications regularly and accordingly could lose weight and live a healthy lifestyle.

Accordingly, the results indicated that perceived affection towards behavioural intention is partially supported (H_1). The variable of pleasure and dominance have significant positive effects on the behavioural intention to use, thus supporting H_{1d} and H_{1f}. Despite that, the relationship of arousal towards intention to use was not significant (H_{1e}). Thus, the results are slightly different from the study by Sharifi (2013), which showed the relationship of perceived affection is stronger than perceived cognition towards the behavioural intention to use.

As expected, pleasure has a significant positive relationship towards behavioural intention to use, which is similar to findings in a few studies (Demangeot and Broderick, 2010; Kulviwat et al., 2007; Sharifi, 2013), and supported the hypothesis H_{1d}. The result is also in tandem with the CAT model (Kulviwat et al., 2007), indicating that pleasure influenced technology adoption. It does describe that obese people's attitudes towards behavioural intention to use mobile health applications are positively influenced if they are happy and pleased about a high technology mobile intervention.

However, this study has produced an insignificant relationship between arousal and behavioural intention to use mobile health applications (rejected hypothesis H_{1e}). These findings contradict the CAT model (Kulviwat et al., 2007), which reported a significant relationship between arousal and intention to use. There are several reasons why obese people might feel less aroused when considering mobile health applications owing to a few barriers and these being more interesting than other types of technology. Some of the obstacles are limited

regulation, lack of trust, sensitive personal information (privacy), and the security of the users' information. They might feel that the information requires to be safeguarded, which are reasons that merit caution and become barriers for the consumers to use mobile health applications (Kao and Liebovitz, 2017). These barriers will indirectly impact their attitude towards the use of mobile health applications.

In addition, the findings showed that dominance produced a significant effect to the behavioural intention to use mobile health applications and accepted hypothesis H_{1f}. The result contradicts the underpinning model which shows insignificant dominance towards intention to use (Kulviwat et al., 2007). The possibility that dominance influences the behavioural intention to use mobile health applications is because the obese people in this study own at least a smartphone, and the applications are well-known to them, compared to the study by Kulviwat et al. (2007), which focused on high technology innovation.

Overall, this result is closely similar and supports the study of Huang et al. (2017), which reported that pleasure and dominance are significant towards behavioural intention to use technology innovation. For instance, when users use mobile health applications, they might probably feel the happiness and excitement from the functions and services provided by the applications. These messages of good emotion would encourage their intentional behaviour towards the use of mobile health applications.

In addition, the results revealed that perceived susceptibility and perceived severity had positive significant effects on behavioural intention to use. To a certain extent, these results support previous research (Saunders et al., 2013) by demonstrating a direct relationship between perceived susceptibility, perceived severity and behavioural intention to use. The findings supported hypotheses H_{1g} and H_{1h}.

There has been a significant effect between perceived susceptibility and behavioural intention to use (hypothesis H_{1g}). The results are also similar to the study findings by Saunders et al. (2013) related to health behaviour. It does show that obese people thought their condition

would develop into a more severe situation in the future. They became worried about their obese state, and if there was no action or a lack of efforts in taking care of their health, it may negatively affect their lifestyle.

There was also a significant effect between perceived severity and behavioural intention to use, confirming hypothesis H_{1h}. This study confirmed the results of previous studies that showed a significant relationship between perceived severity and behavioural intention to use mobile health by (Zhang et al., 2019) in China. Indirectly, the applicability of health behaviour theory has been verified in the context of mobile health application adoption, specifically among patients of non-communicative diseases like obesity. Based on the findings in this study, it could be suggested that when someone recognises his habitual lousy behaviour, it is more likely that they will see the advice as a threat.

Looking at the element of compatibility, the findings support prior studies which showed a positive relationship between compatibility and behavioural intention to use (H_{1i}), such as the study by Meri et al. (2019). Nevertheless, there have also been initial studies which found negative or non-significant relationships between compatibility and behavioural intention to use (Karahoca et al., 2018; Shareef et al., 2014).

In seeing that compatibility constructs have a significantly positive influence on the behavioural intention to use mobile health applications, the result of the study is in line with prior research by Ndayizigamiye and Maharaj (2017) that have examined mobile health among health care professionals. In addition, the findings also support the study of Meri et al. (2019), having brought compatibility from a different view of health innovation technology, which is using cloud health information systems. Hence, mobile health applications innovation should be compatible with the needs of obese people to ensure successful implementation of interventions.

Based on data analysis conducted, it revealed a significant positive relationship between accessibility and behavioural intention to use mobile health applications, and this supported hypothesis H_{1j}. This result is consistent with the study by Ye et al. (2019) that reported a significant relationship between accessibility and behavioural intention to use mobile health.

One of the possible reasons obese people intend to use mobile health applications is when the chances to access health information are difficult to retrieve physically. Therefore, they choose to use mobile health applications as a solution to access the information quickly and fulfil their needs. In the study by Ye et al. (2019), they have found that patients who find difficulty to receive health services are the potential consumers to use mobile health applications, compared to those who have easy access to medical resources. For example, if they are living nearby a hospital or healthcare service centre, the patient would prefer to go to the centre first, instead of receiving health information via mobile health applications.

Overall, the findings demonstrated that perceived cognition, perceived affection, perceived threat, compatibility and accessibility would act as important constructs to influence behavioural intention to use mobile health applications.

Hypothesis 2. Perceived cognition, perceived affection, perceived threat, compatibility and accessibility have significant positive effect on attitude.

This study attempted to ascertain that perceived ease of use positively affects the attitude in the use of mobile health applications context (H_{2a}). Based on the results, the relationship was directly supported, and previous research in almost similar contexts also showed a significant relationship between perceived ease of use and attitude (Karahoca et al., 2018).

However, there is insignificant relationship between perceived usefulness and attitude (H_{2b}), which contradicts with the findings of prior research by Karahoca et al. (2018) as well as Alsaleh and Thakur (2019). One possible reason for this result to reveal differently may be that these obese people believe that there is an advantage in using the mobile health applications. However, they are still in doubt on the functions of such mobile health applications themselves.

In another, the variable of relative advantage had a significant positive relationship with the attitude construct (H_{2c}). This result reflected that obese Malaysians do believe in the innovativeness of alternative ways towards the use of mobile health applications.

It was also found that there was a significant positive relationship between pleasure and attitude (H_{2d}). The finding may be attributed to the underpinning CAT model, which found a substantial relationship between pleasure and attitude (Kulviwat et al., 2007).

Furthermore, insignificant results were also found between arousal and attitude (H_{2e}) in this study. However, the results do not seem to be consistent with previous studies (Alsaleh and Thakur, 2019; Kulviwat et al., 2007). Meanwhile, it was supported by the study conducted by Kulviwat et al. (2016) that shows arousal is moderately low in reliability. The result might give a description of respondents that are quite calm and inactivite towards positive attitude.

Besides, the findings indicated that dominance has a significantly positive relationship with attitude (H_{2f}); and this result supported a prior study by Alsaleh and Thakur (2019), but contradicts with the findings of Kulviwat et al. (2007).

When a mobile health application excites an individual, it favourably influences his view about adoption. The study results suggested that technology is difficult enough to produce a greater degree of dominance-related feelings. These findings were in line with Alsaleh and Thakur's (2019) research which used the same CAT Model (Kulviwat et al., 2007) and discovered similar findings with the researchers, mainly dominance significantly affects the attitude towards high-technology adoption.

In another, the perceived threat (with the construct of perceived susceptibility and perceived severity) result revealed that both constructs have a significant positive relationship with attitude (H_{2g} and H_{2h}). Accordingly, the result implies that perceived threat (perceived susceptibility and perceived severity) from the Health Belief Model (Becker, 1974), would determine the positive effects on attitude towards using mobile health application. To some extent, the result seems to conform with the statement that the more seriously people perceive their diseases, the more likely they are to have positive engagement (Zhang et al., 2019) with mobile health applications.

Besides, the findings revealed a positive and significant relationship between compatibility and attitude (H_{2i}) among obese people towards their behavioural intention to use mobile health applications. These results are consistent with those found in the study by Ndayizigamiye and Maharaj (2017). In mobile health applications, a minor study has focused on a direct relationship between compatibility and attitude. The attitudes of healthcare consumers and providers were found to be the primary determinants of adoption intentions while using healthcare devices (Karahoca et al., 2018). Perhaps, when the attitude is positive, the potential of adopting any technology innovation also has a more significant impact.

In another, the finding from this study also showed significant relationship between accessibility and attitude (H_{2j}), thus hypothesis H_{2j} was supported. In addition, it shows that technology acceptance, such as mobile health applications, could be significant with accessibility as an independent variable. The possible reason it happens is that some mobile health applications are premium-based applications. However, in this study, the subjects were obese people. Therefore, some applications that have been designed specifically for obese people are limited.

Hypothesis 3. Attitude has significant positive effect on behavioural intention to use.

Few studies have embarked on demonstrating the interrelationships between attitude and behavioural intention (Karahoca et al., 2018; Zhang et al., 2019). The result revealed that attitude has a significant positive relationship with the behavioural intention to use (hypothesis H_3). To some extent, the result seems to conform with Consumer Acceptance of Technology (CAT) model, which highlights attitude to play mediator role in the model (Kulviwat et al., 2007). Not only in the CAT model, but also several other theories and

models. For instance, Technology Acceptance Model (Davis, 1989), Theory of Reason Action (Fishbein and Ajzen, 1975) and others.

The findings of the current study are consistent with Karahoca et al. (2018) as well as Zhang et al. (2019). In addition, Hussein et al. (2017) have highlighted that attitude is a crucial component in promoting the adoption of mobile health applications. These findings have given compelling evidence that, by including compatibility and accessibility as elements in a Technology Acceptance Model, it is feasible to obtain a more comprehensive picture of attitude towards behavioural intention to use mobile health applications.

Hypothesis 4. Attitude mediates relationship between perceived cognition, perceived affection, perceived threat, compatibility, accessibility and behavioural intention to use.

Out of the ten hypotheses, H_{4c} and H_{4e} were found to not present mediating effects. Meanwhile, the remaining hypotheses (H_{4a}, H_{4b}, H_{4d}, H_{4f}, H_{4g}, H_{4h}, H_{4i}, and H_{4j}) were all significantly positive and showed mediating effects.

In this study, the results suggested that attitude and behavioural intention were closely linked to each other. Generally, obese people with a positive attitude have a higher extent to use mobile health applications. The findings supported past study in mobile health services in Bangladesh that used the Unified Theory of Acceptance and Use of Technology (UTAUT) model as the underpinning theory (Alam et al., 2020). Even though there were differences in terms of view, their result was found to be similar to the study's findings on behaviour towards technology adoption.

Two hypotheses (H_{4c} and H_{4e}) were found to be not significant. Specifically, the non-significant relationships were found (H_{4c}) for attitude as mediator for the relationship between relative advantage and behavioural intention to use. Contrary to expectation, the result indicated that attitude did not mediate the relationship between relative advantage and behavioural intention to use. The result is not in line with the underpinning model, which is the CAT model (Kulviwat et al., 2007). As indicated by the result, obese Malaysians seem to be less intentional in using mobile health applications, if it is just referring to the benefit of using it. Another possible explanation is that the respondents are more likely to sit face-to-face with medical practitioners than just rely on mobile health applications. Current studies have shown that patients, especially women, prefer making doctor's appointments compared to using mobile health applications (Ye et al., 2019).

Hypothesis (H_{4e}) also was not supported for the mediation effect between arousal, attitude and behavioural intention to use. As expected, no mediation effect between arousal, attitude and behavioural intention to use. The result is not surprising because relationship between arousal and behavioural intention is also insignificant, therefore constraining the obese as a user of mobile phones to use the mobile health applications. These research findings are similar to the study by Huang et al. (2017). They might occur due to the fact that specific mobile health applications for obese people are limited. Most applications are either developed for a general health issue or those services are interlinked to the healthcare centre. Therefore, it seems that obese people are less emotional towards mobile health applications.

6 CONCLUSIONS

To conclude, this study has provided meaningful information on factors influencing the attitude and behavioural intention to use mobile health applications among obese people in Malaysia. Specifically, the findings of this study have enabled the researchers to identify factors affecting behavioural intention as well as to provide better understanding of obese people' influence to use mobile health applications.

The findings of this study indicated that Malaysian obese who had more thought of perceived cognition, perceived affection, perceived

threat, compatibility and accessibility were able to influence their behavioural intention to use mobile health applications. Moreover, the findings have indicated that the mediating effect of attitude influenced on the relationship between perceived cognition, perceived affection, perceived threat, compatibility, accessibility and behavioural intention to use mobile health applications among obese people.

Firstly, the study uses multiple theoretical models to identify the antecedents for measuring behavioural intention to use mobile health applications among obese people in Malaysia. As indicated by the researchers, various theoretical models form a robust framework that integrates theoretical efforts to support multiple constructs. In the conceptualization of this model, the variables, namely perceived cognition, perceived affection (Alam et al., 2020; Karahoca et al., 2018), perceived threat (Glanz et al., 2008), compatibility (Olok et al., 2015), accessibility (Hsu and Liao, 2014) and behavioural intention to use (Kulviwat et al., 2007), are incorporated to make improvement, according to the present situation. The literature on these variables were further explained subsequently. Thus, considering the relevant variables parallel with the current scenario, this conceptual model was specifically formed for obese people in Malaysia. Referring to the statistics, it is gradually rising the number of obese people in Malaysia. Through this research framework it is hoped that the stakeholder such as government, healthcare organization and others could use it as reference to promote healthy lifestyle using the health applications technology.

Secondly, limited prior research have used the Consumer Acceptance Model (CAT; see Kulviwat et al., 2007) to discuss the behavioural intention to use, specifically in the context of mobile applications. Therefore, the framework proposed in this research would be beneficial for academicians to understand factors affecting intention to use mobile health apps in the future. By including two new constructs, namely compatibility and accessibility alongside the CAT Model and HBM Model, this research goes beyond what Kulviwat et al. (2007) proposed

in the CAT Model. These additional variables of mobile health applications have been overlooked in the previous literature.

Fourthly, past studies on the research of behavioural intention to use mobile health applications were conducted in developed countries, such as the USA. On the other hand, Malaysia is a multi-lingual, multi-ethnic, and multi-religious Southeast Asian nation with a population of more than 33.4 million people. Since the literature on behavioural intention to use mobile health applications in local studies is limited, this research has added value to the current body of knowledge. This research presents results that can be compared to other studies of a similar scenario and provides empirical evidence for the importance of behavioural intention antecedents in a particular cultural context.

This research provides various practical implications for behavioural intention to use mobile health applications in general and health management applications specifically. This study has made a practical addition to the multiple uses of mobile health applications. Therefore, the findings should be of interest to the government, healthcare organizations, software developers and consumers.

Referring to the benefits of this research to the government, the latter needs to encourage every individual to use mobile health applications. People are able to live a healthy lifestyle via mobile health applications with low or affordable costs of services (Pai and Alathur, 2021). By identifying multiple factors influencing the behavioural intention to use mobile health applications, healthcare practitioners and stakeholders can quickly get the true reflection of the reality for the requirements and specifications to ensure that universal health coverage goals will be successful. For instance, obese people in Malaysia may require the mobile health applications that show food calories calculators. The applications should provide information which are related to Asian food and closely represent those items specific to Malaysia. Moreover, Ye et al. (2019) have also suggested that mobile health plays a crucial role in providing and assigning medical resources

and supplying government agencies with the theoretical basis for developing mobile health policies. Particularly so during this pandemic, data collection has to be on virtual mode or the most accessible method like an application on a smartphone.

This research will also provide benefits to the healthcare organization. Nowadays, there are many health applications in the market. However, having an official healthcare application that is standardized and interlinked among healthcare organizations is still non-existence, in practice. There are several types of healthcare organizations that require information technology support, namely hospitals, private practice clinics, specialist offices and clinics, nursing homes, pharmacies, rehabilitation centres and others. Mobile health applications could assist medical practitioners in keeping track of their patients' assessments of health and services (Alweshail and Brahim, 2020).

Patients' health needs, including their blood pressure, heart rate, height, and weight, must be regularly tracked; hence when mobile health application is used, tracking is made easy. Besides, it does not limit the healthcare practitioners to give the audience any information about health management. This means that the users of mobile health applications could socialize and connect. Therefore, the healthcare organization needs to have compatible and accessible standardized applications so that every authorized individual could give and receive valid information. Another example is when obese people want to keep an update with their healthcare practitioners regarding their health information. They can easily be connecting with their medical healthcare personnel through the mobile health application. Activities may consist of checking with the appointment date, medicine intake, and even advanced care when there is an emergency. Moreover, their medical healthcare practitioner could also be monitoring them through the applications (Balapour et al., 2019; Chen et al., 2018; Choi et al., 2020; Naddeo et al., 2017).

Besides, this research would also be beneficial to software developers. They would refer to the individual or company that responds to

identify, design, install and test a software system built for particular functions (Davis and Venkatesh, 2004). In particular, the technology engineer and software developers should take into consideration consumer preferences. They need to promote and make the applications easy to use for the users. For instance, visual displays need to be interactive, efficient, and compatible to be used according to their needs. It is vital to create conducive and innovative mobile health applications (Pai and Alathur, 2021) to improve consumers' awareness and recognition of healthcare.

Variables that impact mobile application adoption have been studied with the results being essential to mobile application developers, since they may assist in formulating more suitable and strategic marketing interventions (Dhiman et al., 2019). This study has contributed to the academic literature on behavioural intention to use mobile health applications and contribute to the literature on the CAT model by including three endogenous elements, namely perceived threat, compatibility, and accessibility. The results of this study can be brought to the attention of mobile health application developers to have a better understanding of which behavioural factor influences behavioural intention to use the mobile health applications.

Finally, this research would be beneficial to consumers as they may have influence on the technology applications advancement (Karahoca et al., 2018). The consumer's behavioural intention to use mobile health applications can be achieved by understanding their needs and requirements. The findings indicated that mobile health applications could be accepted regardless of age, gender and educational background. It has also been supported by WHO (2018) that demographics do not influence the use of smartphones or mobile phones. However, their perceived cognition and affect do influence their attitude towards the use of mobile health applications.

Furthermore, there are benefits for the individuals, particularly among obese people, to use mobile health applications, as discussed in the literature review. Among these benefits

are quick access to the health information (Balapour et al., 2019; Chen et al., 2018; Choi et al., 2020; Naddeo et al., 2017) and self-monitoring (Balapour et al., 2019; Chen et al., 2018; Choi et al., 2020; Naddeo et al., 2017).

Moreover, mobile health applications can provide information regardless of the location of the user either in urban or rural areas (Kaium et al., 2020). The most vital prerequisite is for the consumers to have compatible devices and accessible applications to be used anytime and anywhere. In line with the CAT model and prior studies, the results of this study indicated that compatibility and accessibility of the applications may influence consumers or obese people, specifically their behavioural intention to use the mobile health applications.

As the findings and literature supported in this study show, the introduction of mobile health applications can promote self-efficiency for patients, increase access, and strengthen the links in ambulatory and hospital settings between patients and healthcare professionals. There are other aspects that could be considered as the reasons consumers should use mobile health applications. However, the researchers had limited the scope to examine obese people and mobile health applications. Future studies could perhaps improve and discuss further on the aspects that have not been covered in this study, namely safety and security, policies and regulations, financial and others.

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