INVESTIGATING THE RELATIONSHIP BETWEEN THE EXPOSURE TO SMARTPHONE HEALTH APPLICATIONS AND THE INTENTION TO USE THE APPLICATIONS TO GUIDE EXERCISE BEHAVIOR

A Thesis

Presented to

The Faculty of the School of Communication

University of Houston

In Partial Fulfillment

Of the Requirements for the Degree of

Master of Arts

By

Xiaoqing Yang

December, 2014

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ABSTRACT

This research studied how smartphone applications are influencing individual's health-related attitudes and behaviors with regards to the obesity issue. Because there is no research studies that have focused on the impacts of smartphone applications on people's attitude and behavior changes, especially among Chinese respondents, this research explored the relationships among exposure to health-related applications, attitudes towards health-related applications, attitude about the use of health-related applications, attitude about the behavior, self-efficacy for the use of health applications and doing exercise, subjective norms regarding using health applications and doing exercises intentions to use smartphone health applications to guide obesity prevention, and intention to exercise in the near future. An online survey was conducted involving 303 participants in the Henan Institute of Education forum whose readers are mainly from Zhengzhou city, Henan Providence in China.

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Chapter I Introduction

Statement of Problem

Obesity is often viewed as one of the most rapidly increasing health issues and challenges being faced by the world in the 21st century. Simultaneously, during the past decades, the media has also shown an increasing interest in addressing the cause of the "obesity epidemic" (Gard & Wright, 2005; Holmes, 2009; Campos, 2004). Much media interest resulted from the concerns depicted by the World Health Organization (WHO), which had, using data from the worldwide surveys, issued a global health warning stating that the impact has become both very diverse and extreme. WHO (2003) further stated that obesity should be regarded as one of the greatest neglected public health problems of today's time. Recently the World Health Organization (WHO, 2014) has organized a series of proficient consultations to inform policymakers, researchers, and professionals about the problem, estimating that more than 400 million adults (9.8%) can be included in the group of obese people worldwide (WHO, 2000).

Often, the common perceptions are that a greater consumption of energy-loaded food and a smaller intake of nutritious food results in a person becoming either overweight or obese. The pervasiveness of overweight and obese people was mainly

determined using the Body Mass Index (BMI) as an evaluation tool. It has been recommended that when the measurement of BMI was over 25kg/m^2, the individual would be categorized as overweight. Whereas, the person would be categorized as obese if the measurement of BMI was over 30kg/m^2 (WHO, 2003). Based on these standards, it was estimated that the population of the U.K. has higher rates of overweight people and obese people than most of other parts of North-Western Europe (Jebb, 2004). To be specific, the Foresight Report (2007) on obesity estimated that the obesity rate increased in Britain over the last 25 years with nearly a quarter of adults being recorded to be obese as of 2007. The report also cautioned that if no action was taken, 60% of men, 50% of women, and 25% of children from the total population, would suffer from obesity by 2050, stating that "Britain could be a mainly obese society" (Foresight Report, 2007, p.11).

Recent data (NHS, 2010) also reported that the number of cases of overweightness and obesity (BMI ≥25) increased expressively among women, men, and children over the period from 1993 to 2009 in the U.S. According to the National Health and Nutrition Examination Surveys (2013), approximately 69% of American adults were considered to be obese in the period from 2009 to 2010. Further observations revealed an upsurge in childhood obesity within the U.S. (NHNES, 2013). It has been asserted that an increase in the number of obese children within the U.S. is resulting in increasing health problems (NHNES, 2013). Research has demonstrated that obesity and being overweight are

associated with health problems such as high blood pressure, heart disease, and other chronic conditions. It is estimated that approximately 13% of the adults in the U.S. are facing the problem of diabetes as a consequence of their obesity (NHNES, 2013). Therefore, it is overwhelmingly important for U.S. society to take effective measures to control and reduce the risks caused by obesity and being overweight (Wolf, 1998). Wu (2010) mentioned that about one-fifth of the one billion overweight or obese people in the world are Chinese. China was once considered to have one of the leanest populations (WHO, 1989), but it is quickly catching up with the western countries in terms of the prevalence of overweightness and obesity; disturbingly, this transition has occurred in a remarkably short time (Ma et al., 2005). The prevalence of obesity in Chinese people, especially children and adolescents, was considered to be still relatively low (Ji, 2004).

There are many possible factors that lead to obesity or overweightness, including energy intake exceeding the energy usage rate of the body, types of daily intake, metabolic factors, physical activity level, and psychosomatic factors among others (NHNES, 2013). Consequently, obesity mainly leads to hostile metabolic effects, such as triglycerides, cholesterol and insulin resistance, among others. Furthermore, some non-fatal but debilitating health problems are related to obesity, including respiratory difficulties, skin problems, and higher infertility risks (WHO, 2000).

In order to reduce the problems associated with obesity, it is critical to increase society's awareness of the risks related to the issue and, accordingly, create a platform for

spreading health information. This spread of information can, in turn, generate more information leading to an understanding of the issue amongst the public, hopefully leading to a better selection of their daily intake and better weight management. Mass media campaigns have been significantly utilized as a tool for promoting public health issues related to obesity as well as overweightness (Noar, 2006). It is worth mentioning in this context that mass media usually focuses on changing audiences' knowledge base, consciousness, and attitude, which in turn contributes to the goal of increasing public awareness on obesity in the modern world (Avraham & Ketter2008). In the modern era, smartphones have gained popularity in promoting awareness of health issues among their owners. From recent observations, it has been ascertained that from smartphone applications, the accessibility to and the spreading of information both have increased (West, 2012). This capability has helped to raise the awareness of critical health issues among the public (Bedno & Vicsik, 2012).

Against this background, it can be observed that very few studies examined whether smartphone applications were effective in influencing an individual's health-related attitudes and behaviors with regard to the issue of obesity. Smartphones have significantly gained popularity, but researchers have not delved much into the subject to establish the extent to which smartphone applications could help to address the problems related to obesity. Therefore, this study intended to find the relationship between the exposure to smartphone health applications and intention to use the

applications to guide exercise behavior.

Background, Significance, and Contribution

The extensiveness of the mass media health information campaign created an apparently endless flow of information. Contained in the movement are various forms of health information. Lately, the mass media has been evidently benefiting the targeted population by providing them with current and accurate information related to health issues, many of which had been caused by obesity (Zhou et al., 2013). The health community had emphasized that the power of the mass media could distribute information about health risks to the public so that they could take effective prevention measures (Signorielli, 1993). Specifically, there had been a progressively important concept of "media literacy," which was concerned with helping people in developing an informed and critical understanding of the nature of mass media and the impact of the latest technology applied by these information networks (Baran et al., 2004). More explicitly, it is elevation that aimed to increase people's understanding and pleasure of how the mass media works in generating accurate meaning, prearranging data, and configuring paradigmatic reality, operating as a base to enhance one's information.

New media denoted on-demand access of the content at any point of time, anywhere, and on any digital service. By implementing this latest technology, the mass media could reach a larger proportion of the targeted population for providing information regarding health issues caused by obesity, irrespective of time and

geographical limitations (Banerjee et al., 2008). The roots of the notion "new media" could be traced back to the late 1980's and the early 1990's, when the development of digital and electronic media products had just taken place with the introduction of CD-ROMs and WWW-sites (Rosenstiel, 2005). The motive to call these products "new media" was to distinguish them from the conceptualized "old" media products such as TVs, transistor packages, feature films, newspapers, chronicled music, periodicals, and printed books among others (Dominick, 2010). Subsequently, as argued by Creeber & Martin (2008), the new numerical equipment made it imaginable to discover new forms of media that could facilitate communication, interaction, and socialization amid the users to share their viewpoints regarding a particular issue, along with reviving and remixing all existing media arrangements. Notably, most of the latest techniques described as "new media" are ordinal, often having features of being densely interactive, compressible, networkable, and employable. Some examples may be illustrated as the Internet, websites, computer multimedia, video games, CD-ROMS, and DVDs (Gane & Beer, 2008).

Smartphones are denoted as another latest advanced technology that has been quite beneficial in providing information regarding healthcare to the general public (Shin et al., 2011; Chen et al., 2010). The application of smartphones in the healthcare field provides opportunities as well as challenges (Ozdalga et al., 2012). It has been further discovered that the benefits obtained from the usage of smartphones in the healthcare

field can undermine the sole purpose of the information channelized, subject to the increase in the usages and abuses (Gill, Kamath & Gill, 2012). The usage of smartphones today, especially those equipped with many applications such as GPS, accelerometer, compass, and microphones, provides computing and communication capabilities to its users. (Gill, Kamath & Gill, 2012). These instruments allowed new submissions across numerous areas in the form of transportation, environmental monitoring, healthcare, and social networks (Gill, Kamath & Gill, 2012). Because of these advantages of smartphones, there has recently been an increased adoption of smartphones by healthcare professionals as well as the general public (Garritty & Emam, 2006). Healthcare professionals had been mainly using pagers for movable communication until the wide availability of cell phones in the 1990s (Burdette et al., 2008). The arrival of movable Personal Digital Assistants (PDAs) during the 1990s permitted healthcare specialists to establish their contacts and schedules electronically, adding additional expedience to their benefits. The collective functionality of a cell phone, a pager, and the PDA substituted by a solitary device called a "smartphone" became very popular among healthcare specialists as well as the general public in the 21st century (Fortney et al., 2011; Wu et al., 2010). The emergence and the development of the social media and advanced technology, such as smartphones, have changed the ways of individual interactions within society drastically. It can be, therefore, rightly be inferred that social networking sites and the usage of smartphones has given rise to the latest technology of human interface

(Newbold & Campos, 2011).

Correspondingly, there are certain basic theories that could provide an in-depth understanding with regards to the promotion of health issues by applying mass media and smartphones. For instance, media advocacy signified the strategic usage of mass media for supporting the community organizer's efforts in spreading information related to obesity and social health issues (Kreuter, 2005). It is in this context that agenda setting theory denoted people as mainly exposed to the preferred media, wherein the individuals place their importance on similar issues within their preferred media (Shaw, 1977). Many theories could be implemented to help explain that mass media could be utilized in providing information to the general public regarding health issues related to obesity and overweightness. In recent studies, the broadcasting effects were summarized as the theory of "social constructionism," which is also vital in the modern context (Scheufele, 2000). In a similar context, Gamson & Modigliani (1989) also explained that "media discourse is part of a process by which individuals construct meaning, and public opinion is part of the process by which journalists develop and crystallize meaning in public discourse." In accordance with the application of the mass media messages, it has become easy to reach the targeted population. Furthermore, the aforementioned theories herein reflect the importance and the necessity of mass media and smartphones in order to provide information to the general public regarding health issues associated with obesity.

In addition, according to Ajzen's (1985) theory of reasoned action, attitude towards

behavior, subjective norms, and perceived behavioral control together shape an individual's behavioral intentions and traits (Ajzen & Madden, 1986). The theory of planned behavior explained why people perform certain actions. Correspondingly, it has been observed that they do so because they formed an intention to carry out the actions in a systematic and objective-oriented manner (Gasser et al., 1985). It is in this context that intentions were prejudiced by the individual's principles and community pressure, which was associated with TRA, which mainly deals with an individual's attitudinal behavior (Pentland et al., 2012).

Mass media has considerable potential for affecting health behavior (Robertson & Wortzel, 1978). According to Robertson (1978), "The pervasiveness of mass media and the exposure levels of broad segments of society suggest that mass media may be an important information source regarding health and a relevant socialization force regarding health attitudes and behavior. Nevertheless, research evidence indicates that most mass media campaigns oriented toward changing health care habits fail"(p.525).

This research study, then, intended to examine the extent to which smartphones provided information related to health issues caused by obesity to an accelerated proportion of a targeted population. More specifically, the current study investigated whether smartphone owners' exposure to smartphone health-related applications helped them obtain or produced positive attitudes towards obesity prevention, and created any

intention to prevent the occurrence of obesity.

Scope of This Research

This paper intended to analyze the application of the smartphone to combat obesity. Moreover, this research study examined smartphone users' attitudes towards and intentions of implementing the advocated practices suggested by smartphone health-related applications to prevent obesity.

Accordingly, this empirical research would be a questionnaire survey. Cross-sectional data and information was collected from respondents sampled in the Chinese market. This research study used an online survey system, "SO JUMP," to deliver questions to potential participants. The final sample size depended on the number of effective questionnaires returned.

Structure of the Research

The following chapters of this paper were arranged as follows. Chapter II was a literature review, outlining the primary theory and the literature work related to studies on media influence on health and the theory of planned behavior, which explained an individual's behavioral change. The literature supported the analysis, the statement of consumer attitude, and the final results of the research. It also covered some previous empirical studies about media influence on the problems of obesity. Chapter III subsequently followed through the research method, including participants, research approaches, variables, data collection, and analysis. The findings of the empirical study

were presented in Chapter IV, followed by discussion of the results as well as the limitations of the study, in Chapter V.

Chapter II Literature Review

Prevalence of Obesity

Haslam and James (2005) defined obesity as a ratio of overly high fat and lean tissue. It is identified by BMI (Body Mass Index). If an adult's BMI is higher than 30, this person is obese. Obesity can also be defined by one's waist size (Maffeis et al., 2008). Normally, if it is more than 40 inches for a male and 35 inches for a female he/she has obesity. People considered to be obese are usually physical inactive and have high blood pressure (BMI, 1998). The prevalence of obesity in America was deemed alarming because in 2012, 64% of adult Americans were considered obese, but only 15% of adults were obese during the time period of 1976-1980 (Matusitz & McCormic, 2012). These figures also reflected the increase in the risk of obesity among children. Obesity affected people of all races, genders, and ages within every state in America. The prevalence of obesity had increased significantly over the last several decades and indications are that this trend will continue not only in developed but also in developing countries (Popkin and Doak 1998; Wang and Lobstein 2006). China is also fighting obesity, as is the rest of the world (Cheng, 2001). Wang (2014) also mentioned that China has the second-largest number of obese people in the world, behind only the United States. A study by the University of Washington's Institute for Health Metrics and Evaluation (2014) stated there were 46 million obese Chinese adults and 300 million who were overweight. Obesity had become an increasingly important public health problem in China, even in

children and adolescents. For example, University of Washington's Institute for Health Metrics and Evaluation (2014) also found that 23% of Chinese boys under age 20 were overweight or obese, while the comparable figure for girls was 14%.

Moreover, obesity could be influenced by a variety of factors including biological, genetic, behavioral, social, cultural, and environmental (Maes et al., 1997). However, the main factors that influenced high rates of overweight and obese children and adults were individual behaviors and the environment, which were related to the excess caloric intake and lack of physical activities (Caballero, 2007).

Social environment and economic issues might also cause obesity (Chang & Lauderdale, 2005). For example, an unstable social environment might lead people to ignore health-related problems. On the other hand, family and friends might influence each other because they might have similar eating habits and lifestyles. Finally, obesity could be caused by medical problems such as Prader-Willi syndrome, Cushing's syndrome, polycystic ovary syndrome, and other diseases and conditions (Kopelman, 2000).

Health Consequences of Obesity

Beyond the stigmatization of viewing obese persons as lacking acceptable physiques, obesity is linked to numerous detrimental health consequences. People who are obese will have a higher risk of health problems and illnesses such as high cholesterol, Type II diabetes, hypertension, coronary heart disease, sleep apnea, stroke, respiratory problems,

different cancers for instance colon and breast, high blood pressure, gall bladder disease, and osteoarthritis (Savini et al., 2013). Boulos and colleagues (2011) indicated that 97% of diabetic patients were obese; and this is also true of 70% of persons who had heart disease, 11% of those with breast cancer, and 10% of those with colon cancer. Research conducted by Nagai (2011) revealed that obese persons who are 40 years old had a six-year shorter lifetime as compared to those who were not overweight. Apart from the associated health risks, obesity involves both direct and indirect costs (Wolf & Colditz, 1998). Wang et al.（2008） pointed out the direct medical costs which may include preventive, diagnostic, and treatment services related to obesity. Being overweight can affect blood pressure, result in high blood pressure, and is a key factor in multiple health problems. Adults who have hypertension or chronic high blood pressure have a shorter lifespan because the body needs to use oxygen and nutrients to live, which means the body requires the blood vessels to circulate more blood to the additional fat tissue (Vasanet et al., 2002). As a result, the workload will increase because the heart needs to pump more blood through the blood vessels. In addition, more circulating blood means more pressure on the artery walls, and the higher pressure on the artery walls will increase the blood pressure (Gribbin et al., 1971). Blood pressure is the force of blood pushing against the walls of the arteries as the heart pumps blood (Macoviak, 2005). If this pressure rises and stays high over time, it can damage the body in many ways. When weight increases, the bulk of tissue increases, and there is an increase in the expenditure

of energy and the demand for blood (Whyte, 1959).

On the other side, insulin resistance is often seen with some additional conditions, such as obesity, increased blood sugar levels, high blood pressure and so on (Kahn & Flier, 2000). Hence, obesity is the major cause of type 2 diabetes (World Health Organization [WHO], 2013). Normally the body breaks down food into glucose and then carries it to cells throughout the body. The cells use a hormone called insulin to turn the glucose into energy. In type 2 diabetes the body's cells don't use insulin properly (Anderson, 1988). At first, the body reacts by making more insulin. Over time, however, the body can't make enough insulin to control its blood sugar level. Diabetes is a leading cause of early death, Coronary Heart Disease (CHD), stroke, kidney disease, and blindness (Boutayeb & Boutayeb, 2005).

Furthermore, as the body mass index rises, so does the risk for coronary heart disease (CHD). CHD is a condition in which a waxy substance called plaque (plak) builds up inside the coronary arteries (Smith, 2010). These arteries supply oxygen-rich blood to the heart. Plaque can narrow or block the coronary arteries and reduce blood flow to the heart muscle. This can cause angina (chest pain or discomfort) or a heart attack (Michaels & Chatterjee, 2002). Obesity also can lead to heart failure (Sin et al., 1999). This is a serious condition in which your heart can't pump enough blood to meet your body's needs. Research has found that the probability of atherosclerosis developing in obese people is 10 times more than it is in those people who are not obese; also, there

is a higher rate of coronary artery disease in obese people (Thom et al., 2006). The reasons are that fatty deposits are built up in arteries that help to support the heart. Therefore, narrowed arteries and reduced blood flow to the heart will cause chest pain or a heart attack. These kinds of diseases are very dangerous and can lead to death (Must, 1999).

Additionally, the added weight of the chest wall squeezes the lungs and causes restricted breathing (Siregar et al., 2009). As a result, some people may have sleep apnea (and do not have sufficient sleep at night) and respiratory problem, which will influence their daily work and normal lifestyle. Sleep apnea is also linked to heart disease (Wilcox et al., 1998).

The National Cholesterol Education Program (1989) has identified metabolic syndrome as a complex risk factor for cardiovascular disease. Metabolic syndrome consists of six major components: abdominal obesity, elevated blood cholesterol, elevated blood pressure, insulin resistance with or without glucose intolerance, elevation of certain blood components that indicate inflammation, and elevation of certain clotting factors in the blood (Grundy, 1999). In the U.S., approximately one-third of overweight or obese persons exhibit metabolic syndrome (Stanford Hospital & Clinics [SHC], 2014).

In a culture where often the ideal of physical attractiveness is to be overly thin, people who are overweight or obese frequently suffer disadvantages. Overweight and obese persons are often blamed for their condition and may be considered to be lazy or

weak-willed (Haskins & Ransford, 1999). It is not uncommon for overweight or obese conditions to result in people having lower incomes or having fewer or no romantic relationships. Disapproval of overweight persons expressed by some individuals may progress to bias, discrimination, and even torment (Stanford Hospital &Clinics [SHC], 2014).

Mass Media, Smartphone Applications, and Health

Mass Media and Health

Communication is considered critical and central to healthcare. In the past, communication was oriented towards the healthcare professionals, but this has been revolutionized to the need for a participative, patient-oriented approach in which decision making is shared between patients and providers (Eysenbach, 2000). This has led to increased interaction between patients and health-care professionals within healthcare settings where important and sometimes critical information is communicated and decisions regarding lifestyle changes and medication options are made. In the traditional setting, the patient is expected to visit healthcare facilities when they are in need of consultation or treatment (Kiguli et al., 2009). However, this has been changing with the advancement of mass media. The participation of the media in healthcare began with the communication of certain health concerns either directly through newscasts, advertisements or indirectly in the promotion of positive healthy trends (Robertson & Wortzel, 1978).

The media (especially mass media) has significant impacts on individual and population health, especially through affecting youth health behaviors (Wakefield, Loken & Hornik, 2010). It is estimated that 27% of the patients comment about their health experiences through social media. In addition, one out of two people who are in the 25 to 34 year- old age group is making decisions based on social media (Thielst, 2010).

In addition, there are some studies that demonstrated the influence of radio, TV, and print media on health. First, radio is a no-face form of media (Meyrowitz, 1989), which does not affect people in a visible way. However, people can have it anywhere (like home or cars) at any time. It can spread humor, news, political, or health information. It can become a habitual behavior in the end. Second, television, which sends out hundreds of types of programs, is one of the most popular forms of media. These programs are visible, which makes viewers have a deeper influence from these programs (Graves, 1999). Many experts have health lectures or programs on TV shows, which can attract people to pay attention to their health; however, the TV shows only impact viewers for a short time. Moreover, television behavior can influence humans by inciting emotion in the audience, and then their mentality may change, as might their behaviors (Hall, 1974). Further, newspaper and magazines are appealing because they are glossy and usually include images attractive to people (Chen & Meindl, 1991). However, there is a high level of competitiveness among newspapers and magazines because there are many with the same themes, for example: fashion, beauty, television information, famous people and

their private lives, house designs, sports, Internet surfing, and health. They can be a strong form of pressure in many ways (Reeve & Nass, 1996). They try to guide people's lifestyle issues like relationships through providing questionnaires or surveys. They try to change the minds of readers by discussing things about which they have positive or negative feelings. They are good at manipulating images in order to sell products/information.

Currently, the Internet is the most powerful form of media. People spend lots of time online each day, which includes socializing, playing, reading, and even conducting business (Shah et al., 2001). The Internet has so many avenues to enable people to consume media. With the development of the Internet, people are not just the consumers but also the producers of media (Hardey, 1999). Everyone has the right and the ability to publish news and views online. As a result, some of the personal views may be unreliable; on the other hand, the professional organizations online are believed. Hence, the relevant health organizations that publish some health news are believed by many people (Hew & Hara, 2007). In addition, with the invention of social media and the extensive use of websites and blogs, communication of health messages has gone a notch higher. Through these sites the consumer, being the patient, is able to obtain information much more easily, thereby reducing the amount of time this would take if the person were in a health facility (Schwitzer, et al., 2005). Detmer (2010) stated that, although a patient may visit a health professional four times in a year, the same patient may gather relevant

information on prevention and management of certain health issues many more times in a month from a website. This validates the contribution of mass media in the promotion of health (Singh et al., 2010)

Smartphone Applications in Health

Smartphones are becoming increasingly common in both personal and professional spheres. Some reports suggested that there were now estimated to be more than 1 billion smartphones and tablets globally; some sources estimated that this reached 2 billion by 2014 (Aitken & Gauntlet, 2013). In 2012, China overtook the U.S. to become the key volume in smartphone marketing, and other major emerging economies are expected to see strong growth rates for these devices, too (Gordon, 2013). These devices have many features that can be successfully harnessed in healthcare including rapid access to information, instant communication and improved organization (Robinson, 2013). Smartphones have changed the manner in which interactions occur among health materials, patients, and health professionals. Mobile phones are convenient tools for searching information anywhere through the wireless Internet; hence, it replaces desktops and makes both clients and health professionals able to obtain information wherever they are (Wilding, 2006). But more than just enabling Internet access, these devices have brought a complete change in the way health-care processes are carried out. This has been enabled by the use of various applications that are downloaded and run on the phones' operating platform.

First, apart from the short message alerts or the information gathered on various health concerns from the Internet, the smartphones have built-in sensors which collect data about the client and make the data available in the manner that the consumer can understand and respond to accordingly (Krause, et al., 2006). Such data includes the patient's blood pressure, heart rate and temperature, all of which could only be done in healthcare facilities in the past. Thereby making consumers more aware of whether they are at risk of a certain disease and enabling them to make healthy decisions. These data are especially useful in the management of chronic illnesses among the older population. Additionally, smartphones come with global positioning that can be used to locate the nearest healthcare facilities and emergency centers, thus helping the clients during a health emergency (Harvard Health Publications, 2014). In the healthcare industry, mobile computing allowed by smartphones is becoming an important tool and has grown in popularity among health-care professionals during the past 5 years (Lu et al., 2005 & Lee et al., 2011). However, Computer World (2010) reported that there will be 1.4 billion smart phone users by 2015 and that more than one-third of them will have a health-related app. According to this report, there were about 17,000 mobile health applications in major stores, 74% of which were obtained through application service providers.

Across major smartphone platforms, there are some common applicant categories for health care: health and fitness applications, medical applications, weight-loss

applications, and healthy eating applications. The previous study found that the most popular and useful applications were weight-loss and fitness applications (Harv Womens Health Watch, 2010). For example, the applicants named “Lose It!” and “Calorie Counter” provided a way for people to keep track of how many calories they consume and burn for a better control of their weight-loss goals (Ozdalga et al., 2012). Dolan (2011) reported that there were about 9000 medical, health, and fitness applications available for the iPhone alone. This number has multiplied dramatically. Gill *et al.* (2012) conducted a search on Apple’s iPhone App Store, which yielded 7898 applications when the terms “health” and “fitness” were searched. A Google’s Android Market media store search showed 9522 applications were yielded. A search on RIM BlackBerry App World resulted in 1621 applications when queried “health and fitness” in the search box. China's market for medical and health related applications is rising with more than 2,000 such applications currently available on devices from smartphones to tablets (Mi, 2013).

The technology of the smartphone, as well as health applications, keeps changing the promotion of health, especially in the management of obesity. Smartphones are defined as devices that are mobile and that have added abilities for instant text messaging, Internet access via wireless including e-mail and video viewing. They exist in small sizes and run over platforms including Blackberry, iPhone, and Android operating systems (Nusca, 2009). Applications refer to software products that run on the mobile devices and can be downloaded. Smartphone health applications form the largest proportion of

applications downloaded and used in the US (Food and Drug Administration, 2014). According to ELAarag et al. (2013), 32% of middle-aged adults (30-49), 28% of young adults (18-29), and 20% of those aged above 50 use healthcare applications. These applications cover healthy lifestyles, disease management, fitness, and public health. Recent research gives the suggestion that healthcare applications have the likelihood of supporting interventions for behavior changes in healthcare (Cummiskey, 2011).

Healthcare applications have been used in the management of obesity to target attitude and behavior changes. This has been carried out through preventive, diagnostic, and treatment measures. In preventive measures, applications such as health and fitness have been of great use. These applications have been employed in several ways. First, the link of these applications with relevant objectives and curriculum have enabled schools to offer fitness lessons to their students, with the demonstrations of how certain exercises are carried out (ELAarag et al., 2013). This has acted as a major preventive drive through early education. Further, use of smartphones for the purpose of self-monitoring and for the maintenance of health behaviors has contributed to preventative measures. For example, calorie counter app publishes the daily calorie consumption of the human body together with target weight and relevant physical activities people need to take. The app also generates graphs and charts for easy tracking. One exercise application available on iPhones employs virtual rewards as it tracks the progress of a person's exercise times and amounts. These applications enable people to continually re-examine themselves as to

whether or not they are following a healthy lifestyle. Lastly, fitness and health applications have been used in the promotion of a healthy lifestyle as well as physical activity for the purpose of countering sedentary conduct. Through the use of media advocacy theory, the applications have been used for obesity prevention through strategies of behavior change as well as text messaging leading to a reduction in weight increase and an increase in physical activity (Hearnshaw & Matyka, 2010).

In order to diagnosis the obesity, studies indicate that professionals in a health field that uses smartphone applications have the capability of sending and receiving information concerning patients for the purpose of behavior change, motivation, interventions in decision support, and patient adherence (Knutsen, et al., 2011). These could also include sensor technologies, which take patient data such as temperature and blood pressure and send that information to health professionals (Knutsen, et al., 2011). The data collected from the sensors enables the health professionals to detect increased risk factors for obesity and related diseases thereby helping in early interventions.

These rapid technological developments and the widespread adoption of smartphones raise the question of whether smartphones could provide an effective mechanism for tackling ongoing concerns and challenges related to the health and well-being of the global population. The list of problems is far reaching: for example, about 285 million people worldwide suffer from diabetes; in China, 14.7% of Chinese were overweight (body mass index (BMI; kg/m^2) $\geq$ 25) and another 2.6% were obese

(BMI ≥ 30), such that there are currently (2002) 184 million overweight people, and a further 31 million obese people, in China, out of a total population of 1.3 billion (Wu et.al, 2005); in the United States, 36% of the adult population is obese. The number of obese people in China is growing even faster. There are nearly 100 million obese people in China today, more than five times the number in 2005, when 18 million were obese. Although the prevalence of obesity in China is relatively low compared with Western countries such as the United States, where over half of adults are either overweight or obese, it is the rapid increase of the condition causing concern (WHO, 2005). In many of these cases, lifestyle changes – brought on by means of informing, teaching and supporting those who seek to change – may lead to positive health outcomes (Aharony et al., 2011).

Theoretical Rationale

Cultivation Theory

Kaye (2000) stated, "A good theory helps predict what will happen in the future by giving practical insight into how the phenomenon being studied works." Communication theories that explain uses of technologies are certainly necessary. Hence, this study used cultivation theory by George Gerbner as a guide in exploring effects in the smartphone healthcare application area. Cultivation theory examines the long-term effects of television. The primary proposition of cultivation theory states that the more time people spend "living" in the television world, the more likely they are to believe the social reality

portrayed on television (Cohen & Weimann, 2000, p17). The purpose of the "Cultural Indicators" project is to identify and track the "cultivated" effects of television on viewers. These researchers are concerned with the effects of television programming (particularly violent programming) on the attitudes and behaviors of the American public (Miller, 2005). Cultivation theory in its most basic form, then, suggests that exposure to television, over time, subtly "cultivates" viewers' perceptions of reality (Griffin, 2012).

Gerbner and Gross (1976) state that, "Television is a medium of the socialization of most people into standardized roles and behaviors" (p.175). Gerbner (1980) has developed a theory that is able to explain some of the mechanism of effect in social media and not only the television media. Early cultivation studies produced a great deal of intense criticism on conceptual, methodological, and analytical grounds (Hirsch, 1980). Cultivation theorists argue that heavy readers or heavy viewers of media are guided by the media in their constructions of the world that surrounds them (Gerbner, Gross, Morgan, & Signorielli, 1980). As a consequence, heavy viewers of mass media are less likely to trust others in their social networks and are less likely to participate in their local communities (Gerbner et al., 1980). However, cultivation theory moves close to that of the hypodermic needle, because media, such as smartphone application, is understood as shaping, influencing and effecting peoples' perceptions. Furthermore, the report explored the use of smartphones for the "express purpose of supporting or altering one or more health outcomes" (Kaplan, 2006). Through access to the information, some researchers

have been following the theory to address the specific smartphone applications related to health-care issues in developing countries (Krishna et al, 2009).

The Theory of Reasoned Action and the Theory of Planned Behavior

The theory of reasoned action proposes that behavior is determined by a person's intention to perform that behavior (Ajzen and Fishbein, 1975&1980). It also provides an important framework for predicting and understanding social behavior (Ajzen, 1975). The TRA proposes that a person's intention to perform a behavior is the key predictor of behavioral performance. The researchers suggested that a person's behavioral intention can be influenced by a person's attitude about the behavior as well as subjective norms, which are composed of the individual's beliefs about whether people important to the individual would want him or her to engage in the behavior in question and the individual's motivation to comply with these people (Guo et al., 2007). However, the intention comes from beliefs concerning the result of the proposed behavior (attitude) or the pressure exerted by others' thoughts about the behavior (subjective norms). What one perceives about their capability of performing that behavior (perceived behavior control) additionally determines the person's behavior. This association depends typically on the relationship type and the circumstance(s) under consideration. These two theories therefore put forward that the perceived behavior control as well as the intention to perform the behavior can be directly employed in the prediction of behavioral attainment. As such, behavior performance is mutually contributed to by intentions as well as

perceived behavioral control. For example, whether someone intends to lose weight by giving up red meat or by eating less could be relatively determined by what that person believes.

The Theory of Planned Behavior (TPB) started as the Theory of Reasoned Action in 1980 to predict an individual's intention to engage in a behavior at a specific time and place. The theory was intended to explain all behaviors over which people have the ability to exert self-control (Boston University School of Public Health, 2013). The key component to this model is behavioral intent. Behavioral intentions are influenced by the attitude about the likelihood that the behavior will have the expected outcome and the subjective evaluation of the risks and benefits of that outcome.

The TPB has been used successfully to predict and explain a wide range of health behaviors and intentions including smoking, drinking, health services utilization, breastfeeding, and substance use, among others. The TPB states that behavioral achievement depends on both motivation (intention) and ability (behavioral control). It distinguishes between three types of beliefs: behavioral, normative, and control (Boston University School of Public Health, 2013).

Intention

Assumptions are made that intentions get hold of factors of motivation that affect behavior. The level of strength of one's intention gives the likelihood of performing a behavior. However, the intention can only be expressed if the behavior is voluntary.

Intentions, therefore, affect the performance of a behavior in the control of an individual, and this performance should rise to the degree that one is willing to try. In the case of behavior change towards a healthy lifestyle, the healthcare applications usable with the smartphone can be of help to individuals only if they are willing to commit to using them and if the urge to change to a healthier lifestyle comes from within the individual. The intention of an individual is subject to their attitude, self-efficacy and the subjective norms (Hearnshaw & Matyka, 2010).

Attitude

Attitude is defined as the extent to which an individual favors or un-favors the assessment or judgment of the questioned behavior (Knutsen et al., 2011). Taylor and Todd (1995) described the hypothesis as the generalized attitudinal belief that a behavior will lead to a particular outcome. Although the attitudes of users towards healthcare applications have not been widely researched, there is a general feel of satisfaction with many of them. This is because of the wide acceptance and use of healthcare applications amongst many smartphone owners in the US. Among the varied healthcare applications, fitness and health applications are used mostly although MacGregor et al. (2009) stated that there is a tendency of users to change the applications after 3-4 months of usage. This shows that the applications have been well received and are perceived as having the ability to help the users develop healthy lifestyles.

Self-efficacy

Self-efficacy and behavioral control are seen as almost synonymous constructs. However, self-efficacy is more precisely related to one's competence and to future behavior (Ajzen, 1991). It refers to personal evaluation of as well as the belief in the capability of performing a certain behavior type under constraints specified to manipulate existing situations (Miller & West, 2010). How people perceive their abilities affects their motivation, behavior, emotional reactions, and thought patterns. Generally, people have motivations towards the engagement in conduct that they feel efficacious about. Communication should emphasize improving the self-efficacy of clients. The healthcare applications are modeled in a way that encourages the users that they have the capability of managing their own health through positive behavior change. In the case of people who are at risk of obesity or those who are already obese, through awarding scores or points and reviewing their schedules weekly, the feedback or output of the applications encourages individuals to strive harder and to maintain the healthy lifestyle they have begun. In the case of those that interact with and that provide real-time information to health professionals, receiving feedback or encouragement to continue with prescribed medication causes the clients to naturally feel cared for, thereby increasing their zeal for behavior change.

Subjective norms

According to Singh et al. (2010), subjective norms are social pressures perceived by one either to perform a behavior or not. This social pressure could come from peers or

from the family members. With the increased admiration of having a lean physique in the US, there is pressure for those that have the risk of becoming obese or who are already obese to look for ways of managing the condition in order to attain a desired figure. This kind of pressure makes the affected individual become interested in trying any program that could be of help. Additionally, pressure from concerned parties who have already adopted smartphones for managing obesity is enough to compel one to start the process of behavior modification towards a healthier lifestyle by the use of smartphone applications.

Research Questions

Based on the aforementioned review, the current study examined the relationship between the exposure to smartphone health applications and the intention to use the applications to guide exercise behaviors. Because there are no research studies that have focused on the effect of smartphones applications related to obesity prevention, especially among the Chinese population, this research studied the relationships among the variables, including exposure to the use of health applications, attitudes towards exercise for obesity prevention, attitudes toward using health applications, self-efficacy for exercise and self-efficacy for using health applications, subjective norms for exercise，subjective norms for using health applications, and two dependent variables measured for intention to exercise and intention to use health applications. More specifically, the research questions are as follows:

- Is exposure to obesity-related smartphone applications related to intentions to use health applications to guide obesity prevention?
- Are the variables reviewed above, including exposure to applications, subjective norms regarding the use of health applications, attitudes towards obesity-related applications, and self-efficacy to use health applications as guidance, related to an individual's intentions to use smartphone applications to guide obesity prevention?
- Are the variables reviewed above, including attitudes towards exercise, subjective norms regarding exercise, and self-efficacy for exercising, related to an individual's intention to exercise in the near future?

Chapter III Methodology

The current study is investigating the relationships between intention to use preventive measures to prevent obesity (such as 3 times of 60-minute exercise a week) and exposure to smartphone health applications as well as TRA/TPB variables. A cross-sectional survey study was conducted.

Participants

An online survey was conducted among a sample of 303 participants in Zhengzhou city, Henan Providence in China. Chinese respondents were chosen as the study subjects because very few studies have focused on the relationship between obesity prevention (such as 3 times of 60-minute exercise a week) and exposure to smartphone health applications among this specific population. According to THE Wall Street Journal (2014), a study from the Washington University reported that over the past thirty years the rate of obesity in China has increased tremendously since the statistics shows that there are now 46 million adults with obesity and 3 hundred million who are overweight in domestic China. It was predicted that China has become the second largest obese population only after America. At the same time, with the rapid growth of the Chinese economy, a great portion of the population has begun to use smartphones as the communicative tool instead of letters or other traditional tools. Thus, it is worth it to investigate the smartphone health applications with obesity-related options in China to explore the relationship between these smartphone health applications and obesity

prevention with personal attitude, self-efficacy and intention.

The researcher expected all the participants must be 18 years old or above who could understand English and they have acquired relevant English certification. In addition, the researcher posted the Chinese version for each item so as to ensure the validity of the questionnaire. Participants were asked if they have some type of smartphone. If they didn't have a smartphone, they could withdraw from this survey directly.

***Procedures**:*

The Dean of the Henan Institute of Education approved the distribution of the questionnaire to their forum website. The users of the forum include students, staff, and other people who are not members of the Henan Institute of Education. The researcher posted a recruitment letter to invite the users of the forum to participate in the study. Those who were interested in the study would be directed to the survey link that the researcher posted on the forum. Before they started answering the questions, the participants were required to read a consent form, which briefly stated the title, the purpose, and the benefits or potential harm of this study. The potential participants could click "YES" to finish the survey if they agreed with the consent form. If they chose not to continue, they could click "No" to withdraw. Participation in this project was totally voluntary and participants could withdraw from the project at any time or refuse to answer any particular questions with which they felt uncomfortable.

Participants were asked to answer questions related to exposure to applications, attitudes toward health-related applications, attitudes toward having 3 times of 60-minute exercise a week, subjective norms regarding their family members' and friends' beliefs, self-efficacy about having 3 times of 60-minute exercise each week, intentions to use health-related applications for obesity prevention in the next 6 months, and intention to have 3 times of 60-minute exercise a week in the next 6 months.

The responses from participants were automatically saved in SOJUMP and then were downloaded on the researcher's computer. No names were recorded in the survey or database. No personal identifiers were gathered. The questionnaire took at least 30 minutes to complete.

The study received the IRB approval from the University of Houston.

Measures

The questionnaire items were based on the theory of planned behavior (TPB) for the variables including exposure to health applications, attitude, self-efficacy, subjective norms and intention.

Independent variables

Exposure to health applications was assessed by asking participants how many times a week they use different applications that are related to obesity prevention. Response options ranged from "one time a week" to "more than 6 times a week". Three types of health-related applications were listed, including walking/running applications (such as

Runkeeper, Nike+running, etc.), healthy-eating applications (such as Yummly recipes, Nutrition Quiz, etc.), and weight-loss applications (such as Loss it, Calorie Counter, etc.).

Attitudes towards health-related applications were measured by assessing the extent to which participants agreed or disagreed with the statements on the features of running/walking, healthy eating and weight loss applications on a 5-point Likert scale ranging from 1=Strongly agree to 5=Strongly disagree. Sample questions included "These walking/running applications are good"; "These walking/running applications are useful"; and "These walking/running applications are attractive." "These healthy eating applications are good"; "These healthy eating applications are useful, and "These healthy eating applications are attractive"; "These weight loss applications are good"; "These weight loss applications are useful;" and "These weight loss applications are attractive."

Attitudes towards the use of health-related applications were measured by assessing the extent to which participants liked or disliked the health application usage on a 5-point Likert Scale. Participants responded to three sets of questions: "For me, using these walking/running applications is…"; "For me, using these healthy eating applications is…"; and "For me, using these weight loss applications is…" Responses were assessed by 5-point semantic scales, including very pleasant to very unpleasant, very harmful to very beneficial, very fun to very boring, and very wise to very unwise were applied.

Attitude about the behavior measured by four questions derived from Fishbein& Ajzen（1975）and Feldman& Lynch（1988）by the researcher. Participants were asked

to answer each question on a 5-point scale ranging from 1=Strongly disagree to 5=Strongly agree: 1) Having 3 times of 60-minute exercise a week makes me feel good every day; 2) Having 3 times of 60-minute exercise a week prevents me from becoming sick; 3) having 3 times of 60-minute exercise a week prevents me from becoming obese; 4) Having 3 times of 60-minute exercise a week keeps me fit.

Subjective norms measured by asking participants how they perceived their family members and friends thought about the use of health applications to prevent obesity and having 3 times of 60-minute exercise a week.

Questions related to subjective norms regarding the use of health applications for obesity prevention included: "My family believes I should use running/walking applications to help me prevent obesity and keep fit;" "My family believes I should use healthy eating related applications to help me prevent obesity and keep fit;" "My family believes I should use weight loss applications to help me prevent obesity and keep fit;" "My family thinks it is fine for me to use running/walking applications to help me prevent obesity and keep fit;" "My family thinks it is fine for me to use healthy eating related applications to help me prevent obesity and keep fit;" and "My family thinks it is fine for me to use weight loss applications to help me prevent obesity and keep fit." Questions related to friends are mostly the same as the above that only the subjective was changed to "my friends."

Questions related to subjective norms regarding the behavior (i.e., having 3 times of

60-minute exercise a week) included: “My family believes I definitely should have at least 3 times of 60-minute exercise a week” and “My family thinks it is fine for me to not have 3 times of 60-minute exercise every week.” Questions related to friends are mostly the same as the above that only the subjective was changed into “my friends.”

Self-efficacy was assessed by two different sets according to Hsu and Chiu (2004). All six items employed the 5-point Likert Scale. Two sets included self-efficacy about using health applications to keep fit and self-efficacy about exercising 3 times of 60-minute a week.

The first set of questions were: “How confident are you that you can engage in using health applications regularly;” “How confident are you that you can easily use health applications to help you keep fit;” and “How confident are you that you will always use health applications to guide you to prevent obesity.”

The second set of questions were: “How confident are you that you could have 3 times of 60-minute exercise a week even when you are tired that week;” “How confident are you that you could have 3 times of 60-minute exercise a week when you feel you have not much time;” and “How confident are you that you could have 3 times of 60-minute exercise a week when you don’t feel like to.” Choices included from 1=not at all confident to 5=extremely confident.

Age: Participants were asked how old they are at the time of the survey. They were asked to write their ages directly.

Gender: Participants were asked to circled their gender: A=male, B=female.

Employment: Participants were asked to circle their employment status: A for full-time student, B for employed, C for unemployed, D for self-employed, E for homemaker, F for retired and G for others.

Education: Participants were asked to circle their education status: A: did not complete high school, B: high school, C: some college, D: bachelor's degree, E: Master's degree, F: PHD or higher, G: others.

Income: Participants were asked to select their average income per month: A=RMB0-999; B=RMB1000-1999; C=RMB2000-2999; D=RMB 3000-3999; E=RMB 4000-4999; F=RMB 5000 or higher. (1 RMB = 0.16 USD)

Dependent variables

Intention to exercise: According to Ajzen (2002), this variable was measured by assessing the extent that participants agree or disagree with the following statement: "I intend to have 3 times of 60-minute exercise a week in the next 6 months." Response options range from 1=strongly disagree to 5=strongly agree.

Intention to use health applications was assessed by asking the participants to assess the extent that they agree or disagree with the following statement: "I intend to use health applications regularly for obesity prevention and keep fit over the next 6 months."

Data analysis

All of the statistics were analyzed as a whole through SPSS 19.0. as well as excel

graph. SPSS software, short for Statistical Product and Service Solutions, is comprehensive software for analyzing data. Its basic functions include data management, statistical analysis, and chart analysis and output management.

Multiple Regressions (Pearson, 1908) were applied to examine the hypotheses proposed in this study. Multiple regressions aimed to research the changing rules between several independent variables and two dependent variables through the mathematical relationship so as to analyze the influence and importance degree on the dependent variable.

One is:

Intention to exercise = $\partial 0$ + $\partial 1$ Attitudes about the behavior

+ $\partial 2$ Self-efficacy for exercise

+ $\partial 3$ Subject norms for exercise

In this equation, the independent variables and dependent variables were presented. The ∂_0 is regarded as the constant of the equation and ∂_1- ∂_3 are the coefficients of three independent variables.

Another is:

Intention to use health applications = $\partial 0$ + $\partial 1$ Exposure to health applications

+ $\partial 2$ Attitudes toward the use of health applications

+ $\partial 3$ Self-efficacy for the use of health

applications

$+ \partial 4$ Subjective norms for the use of health applications

In this equation, the independent variables and dependent variables were presented. The ∂_0 is regarded as the constant of the equation and ∂_1- ∂_4 are the coefficients of four independent variables. All the data results are considered significant if the p-value is less than 0.05.

Chapter IV Results

The current study was a cross-sectional survey conducted among a total of 303 respondents from Zhengzhou city, Henan Providence in China. Descriptive data were first reported on demographic variables. Bivariate correlations (Pearson's r) were calculated amongst the dependent and independent variables and multiple regressions were then employed to analyze the predictors of the dependent variables.

Demographics

Among these respondents, 128 (42.24%) of them were males and 175 (57.76 %) of them were females. Most of them were aged from 18 to 29 (71.95%) and all of them were above 18 years old. The mean age was 28 (SD=8.79). A total of 176 (58.09%) participants were employed, which accounts for the majority of the respondents, among which 24 (7.92%) were self-employed. Ninety-two (30.36%) were full-time students and 24 (7.92%) were self-employed. The number of unemployed and homemakers were same, which only had 11(3.63%) for each group. Four (1.32%) were retired and 9 (2.97%) were other. As for the education level, 18 (5.94%) of them obtained Ph.D. degrees. However, most of them (n=122, 40.26%) obtained bachelor's degrees, 71 (23.4%) got some college degrees, and 65 (21.45%) obtained master's degrees. In addition, 15 (4.95%) only finished high school.

It is interesting that approximately one-third of the respondents (n=104) had monthly incomes as high as 5000rmb or higher. A total of 22 participants reported that

their monthly income was about 1000 to 1999rmb. A total of 76 respondents had the average monthly income of about 0 to 999rmb. A total of 40 respondents had the average monthly income of about 3000 to 3999rmb. A total of 33 respondents had the average monthly income of 2000 to 2999rmb and a total of 28 respondents had the average monthly income of 4000 to 4999rmb.

Table1: Presents the demographic data

Demographic	Responses (n=303)	Percentage (100%)
Gender		
Male	128	42.24%
Female	175	57.76 %
Age		
18-29	218	71.95%
30-39	45	14.85%
40-49	25	8.25%
50-59	15	4.95%
Employment		
Full-time student	92	30.36%
Employed	152	50.17%
Unemployed	11	3.63%
Self-employed	24	7.92%
Homemaker	11	3.63%
Retired	4	1.32%
Other	9	2.97%
Education		
Did Not Complete High School	7	2.31%
High school	15	4.95%
Some college	71	23.43%
Bachelor's degree	122	40.26%
Master's degree	65	21.45%
PHD or higher	18	5.94%
Other	5	1.65%
Income		
0 to 999rmb	76	25.08%
1000-1999rmb	22	7.26%

2000-2999rmb	33	10.89%
3000-3999rmb	40	13.2%
4000-4999rmb	28	9.24%
5000rmb or higher	104	34.32%

Bivariate Correlations among Variables

Correlation analysis was conducted to explore the bivariate relationships among exposure to health applications and the variables of the Theory of Planned Behavior (TPB) model. Table 2 and Table 3 display bivariate correlations (Pearson's r) among these variables. The study first employed a bivariate correlation analysis to understand the relationships between the dependent variable (intention to exercise) and each of the three independent variables. The correlation results between each variable are listed in Table 2. As shown in Table 2, significant correlations were found between intention to exercise and the following independent variables: attitudes towards the behavior (r=-.54, p < .01), subjective norms regarding exercise (r= - *.42*, p < .01), and self-efficacy for exercise (r= *.58*, p< .01)

Table 2: Bivariate Correlation Results

	Attitudes about the behavior	Self-efficacy for exercise	Subjective norms for exercise	Intention to exercise
Attitudes about the behavior	1	-0.402**	0.527**	-0.536**
Self-efficacy for exercise		1	-0.504**	0.577**
Subjective norms for exercise			1	-0.422

**： Correlation is significant at the 0.01 level

*： Correlation is significant at the 0.05 level (2-tailed).

The study also employed a bivariate correlation analysis to understand the relationships between the dependent variable (intention to use health applications) and each of the four independent variables (exposure to health applications, attitudes toward using health applications, self-efficacy for using health applications to guide exercise, subjective norms for using health applications). The correlation results between each variable are listed in Table 3. As shown in Table 3, significant correlations were found between intention to use health applications and three independent variables: attitudes toward using health applications (r= -.24, p < .01), self-efficacy for using health applications (r=.70, p < .01), and subjective norms regarding the use of health applications (r=-.58, p < .01). There was no significant correlation between exposure to health applications(r= .*08*, p= .16) and intention to use health applications.

Table 3: *Bivariate Correlation Results*

	Intention to use health applications
Exposure to health applications	0.081
Attitudes toward health applications	-0.239**
Self-efficacy for use of health applications	0.705**
Subjective norms for use of health applications	-0.578**

** : Correlation is significant at the 0.01 level

Multiple Linear Regression Results

Two sets of multiple regressions were conducted with the first set testing the relationships between intention to exercise and three independent variables (attitudes towards the exercise behavior, self-efficacy of exercising, and subjective norms for

exercise). The second set was to test the relationships between intention to use health applications and four independent variables (exposure to health applications, attitudes toward using health applications, self-efficacy for using health applications to guide exercise, and subjective norms for using health applications).

In the first set of multiple regressions it was expected that attitudes towards the exercise behavior, self-efficacy of exercising, subjective norms for exercise were significantly correlated with intention to exercise. After conducting bivariate correlations, a multiple linear regression was performed to test the hypotheses in this study. From bivariate correlation results all of the three independent variables are correlated with intention to exercise. However, attitudes towards exercise and self-efficacy of exercise and subjective norms for use of health applications were entered into the multiple regressions. In addition, five demographic variables were also entered into the regression model, including age, gender, occupation, education and income. The results of multiple regression analysis show that the attitude towards exercise behavior ($\beta = -.34$, $p < .05$) and self-efficacy of exercise ($\beta = -.46$, $p < .05$) strongly predicted intention to exercise in the multiple regressions. The variable subjective norms regarding exercise ($\beta = -.01$, $p = .92$) is not significantly correlated with intention to exercise (Table 4). For the five demographic variables, only gender ($\beta = -2.23$, $p < .05$) strongly predicted intention to exercise in the multiple regressions.

In order to better determine the relationship between intention to exercise and the

other three independent variables such as age, attitude towards exercise behavior, and self-efficacy of exercise in multiple regression analysis, we re-entered these three variables in the multiple regressions. Attitude towards exercise behavior and self-efficacy of exercise were found to strongly predict intention to exercise while age was no longer significant (Table 5).

Thus, the first set of multiple regression equations for predicting intention to exercise can be represented as follows:

Intention to exercise= 2.763+ (-0.36) Attitudes towards exercise behavior

+ 0.44 Self-efficacy of exercise

Table4: Regression Analysis Results (intention about the exercise)

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.679[a]	.461	.447	.79633

Coefficients(a)

Variables	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std.Error	Beta		
(Constant)	3.240	.430		7.540	.000
Age	-.010	.006	-.083	-1.692	.092
Gender	-.218	.098	-.101	-2.236	.026
Employment	.021	.037	.027	.555	.579
Education	-.076	.046	-.079	-1.663	.097
Income	.008	.027	.015	.292	.771
Attitude towards exercise behavior	-.362	.057	-.340	-6.409	.000
Self-efficacy of exercise	.497	.057	.463	8.672	.000

Subjective norms for exercise	-.008	.078	-.006	-.104	.917

a. Dependent Variable: Intention about the exercise

Table 5*: Regression Analysis Result for Variables (without subjective norms)*

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.670[a]	.449	.443	.79860

Coefficients(a)

Variables	Unstandardized Coefficients		Standardized Coefficients		
	B	Std.Error	Beta	t	Sig.
(Constant)	2.534	0.284		8.924	0.000
Age	-.166	.093	-.077	-1.773	0.077
Attitudes about the behavior	-0.386	0.05	-0.362	-7.704	0.000
Self-efficacy for exercise	0.463	0.051	0.431	0.172	0.000

a. Dependent Variable: Intention about the exercise

The second set of multiple regression analysis investigated the predictors of the intention to use health applications (Table 6). In the bivariate correlation results, three of the independent variables, including self-efficacy for using health applications, subjective norms for use of health applications, and attitudes towards using health applications are correlated with intention to use health applications. Only one variable, exposure to the use of health applications was not significantly correlated with intention to use health applications. Thus, exposure to health applications was not entered into the multiple regression models. Self-efficacy for using health applications, subjective norms regarding using health applications, and attitudes towards using health applications were entered

into the multiple regressions together with the five demographic variables, i.e. age, gender, education, employment, and income. Two variables self-efficacy for using health applications ($\beta = .58$, $p < .05$) and subjective norms regarding using health applications ($\beta = -.18$, $p < .05$) were found to significantly predict intention to use health applications (Table 6). No demographic variables were found to be significant. Therefore, demographic variables could not affect individual's behavioral intention to use health applications.

Thus, the second multiple regression equation can be shown as follows:

Intention to use health applications= 1.51+ 0.68 Self-efficacy for use health applications

+ (-0.22) Subjective norms for the use of health applications

Table 6: *Regression Analysis Results (intention to use health applications)*

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.726[a]	.527	.514	.80997

Coefficients(a)

Variables	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std.Error	Beta		
(Constant)	1.695	.608		2.788	.006
Age	-.002	.006	-.016	-.338	.736

	Gender	-.132	.098	-.056	-1.348	.179
	Employment	-.020	.037	-.024	-.537	.592
	Education	.008	.045	.007	.166	.868
	Income	-.048	.028	-.084	-1.727	.085
	Attitudes toward health apps	.088	.133	.029	.664	.507
	Self-efficacy for the use of health apps	.682	.066	.582	10.343	.000
	Subjective norms for the use of health apps	-.211	.066	-.176	-3.181	.002

a. Dependent Variable: Intention to the use of health applications

Table 7：Regression Analysis Result for two Variables

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.670[a]	.449	.443	.79860

Coefficients(a)

Variables	Unstandardized Coefficients		Standardized Coefficients		
	B	Std.Error	Beta	t	Sig.
(Constant)	1.515	0.367		4.131	0.000
Self-efficacy for the use of health apps	0.682	0.064	0.582	10.6	0.000
Subjective norms for the use of health apps	-0.218	0.066	-0.182	-3.314	0.001

a. Dependent Variable: Intention to the use of health applications

Chapter V Discussion

This study investigated how smartphone applications are influencing individual's health-related attitudes and behaviors with regards to the obesity issue. This chapter will discuss the basic statistics and analysis of the data in regard to the research questions. The respondents are all from China and most of them have received a certain education and have an adequate amount of income so that the final data can all be considered effective and deserves further analysis. 307 participants answered the questionnaires and 303 of them were valid responses.

As predicted by the TPB model, for the intention to exercise, attitudes about the behavior, self-efficacy and subjective norms for exercise would explain the vast majority of variance on the intention of participants. For the intention to use health applications, exposure to health applications, attitudes, and self-efficacy and subject norms for the use of health applications would be conducted as the variances on the intention of participants. Results of the present study showed that these independent variables had influences for the TPB model as either positive or negative. The model is correlated for the independent variables and dependent variables from the statistics. Ajzen and Fishbein (2004) stated, "In our publications, we have noted repeatedly that the relative importance of attitudes, subjective norms, and perceptions of behavioral control for the prediction of intentions is expected to vary from behavior to behavior and population to population" (p. 431). This research focuses on the Chinese population so that each variable cannot reflect

the behavior of this population and some independent variables have larger coefficients among this population. Participants are about 18 to 29 years old and the mean age is 28 years old, which indicates most of the respondents are young people and would be inclined to know the usage of smartphone applications, which is of benefit for the research. Most of the respondents have earned a bachelor's degree and have high incomes.

Exposure to health applications

Cohn (2012) found that the number of applications doubled as the number of smartphone users, the sophistication of the health applications, and the marketing muscle behind the health applications all increased. He also estimated that close to 250 million people would download health applications in 2012. Despite this large portion of the population, which continues to increase, very little research has been done on the efficacy of smartphone applications, let alone standard ways of measuring their use. After the calculation of the second equation, exposure to health applications cannot predict the TPB model as the p-value is larger than 0.05. For the exposure to the health applications, the data varies individually from different kinds of applications including the applications related to walking/running, healthy eating and weight loss. The frequency of each choice is almost the same. The results prove that no health applications are really popular among the Chinese respondents and not every health application can fully satisfy the Chinese respondents for the intention to exercise. It can be predicted that due to the thousands of

applications listed in the stores that every Chinese smartphone user will choose whatever he or she likes according to their first impression or the comments, but these applications cannot necessarily have far-reaching impacts on the intention to use health applications.

Attitudes

The original constructs of the theory of planned behavior were useful for understanding the exercise behavior and smartphone usage behavior. For the first equation, attitudes toward the exercise behavior had a positive effect on the intention to exercise. That means the intention to exercise is a strong predictor of exercise behavior in Chinese people. In other words, Chinese people are more active when they are motivated to exercise and believe they will intend to have 3 times of 60-minute exercise a week in the next 6 months. However, attitude toward the exercise behavior refers to the individual's estimation that engaging in the exercise behavior is a good or bad thing to do. From the previous research, Ajzed (1991) clearly defined attitude as determined by the individual's beliefs. Thus, a person who has strong beliefs may have a more positive attitude toward the behavior. Theodorakis (1994) reported exercise was the strongest significant behavior on exercise intention, the greater their attitudes, the greater their intention. Christodoulos et.al (2006) found exercise behavior-related beliefs and attitudes were strongly related to younger-aged people and their exercise behavior. Nevertheless, for the second equation, attitudes toward use of health applications does not predict the intention to use health applications from the results. Wilson and Lankton (2004) pointed

out it is very necessary for application designers to design useful and attractive applications for people. Thus, in this finding, the attitude toward the use of health applications is negative, which means Chinese responders may vary individually in their opinion about whether these health applications are good, useful, and/or attractive.

Self-efficacy

From bivariate correlations analysis and multiple regression analysis toward the self-efficacy for exercise and self-efficacy for using health applications, there is significant correlation between self-efficacy for exercise and intention to exercise. It has a positive effect toward the intention to exercise. Conn (1998) found a strong direct relationship between exercise and self-efficacy in a previous study. In that study, path analysis showed self-efficacy expectations had a direct significant effect on exercise behavior, and lifelong leisure exercise had significant positive effects on self-efficacy. However, in this study, the results revealed that most of the respondents are confident that they could have 3 times of 60-minute exercise per week even when they feel tired and don't have much time. It may be inferred that most people would like to prevent an obesity problem.

The result also predicted between self-efficacy for using health applications and intention to use health applications. In this finding, most of participants agree that health applications can help them with obesity prevention and keeping fit over the next 6 months. Hebden (2012) found that all applications provided motivational tips as a source

of positive encouragement that would assist the young adults in creating more positive beliefs around their ability to change their behavior. However, both equations reveal that self-efficacy is beneficial to the intention. In the other words, it seems that Chinese populations are confident in the health of exercise and believe it would be better for their exercise intention to have the aid of health applications.

Subjective norms

It reveals that subjective norms for exercise can neither predict the dependent variable nor intention to exercise. In the theory of planned behavior, subjective norms determined people's intention to perform a behavior. Behavior is a function of beliefs related to the behavior according to previous studies. Fishbein and Ajzen (1975) suggested that the relative weights attached to attitudes versus subjective norms in the prediction of intentions would vary for different behaviors, while Tremor and Finlay (1996) demonstrated that these weights varied for different types of people. Especially individualists and collectivists will be expected to perceive subjective norms in a different way and subjective norms work better on collectivists (Carbery & Garavan, 2011). In this study, the interesting thing is that bivariate correlations showed a significant relationship between subjective norms for exercise and intention to exercise. The multiple regressions indicated that the relationship between subjective norms for exercise and intentions to exercise was not statistically significant. It indicated that others' perceptions (such as family and friends) did not affect Chinese people's intention to

exercise when other factors entered into the model.

In the second equation of subjective norms to using health applications, both bivariate correlations and multiple regression analysis showed that there existed a significant correlation between subjective norms and intention to use health applications. Accumulated evidence indicates that attitudes and subjective norms are good predictors of intentions and that those intentions are reliable predictors of behavior (Hartwick & Warshaw, 1988). The results demonstrated that subjective norms play an important role in forming Chinese people's intention to use health applications. The subjective norms are more obvious for Chinese people. From previous studies, people aim to consider the implications of their actions before they decide to engage, or not to engage in a specific behavior (Galvin, 1992). Karahanna et al. (1999) found that staff and friends were important influences for technology usage, while computer specialists played a significant role for actual users. Thus, in this finding, family and friends beliefs can affect people's intention to use health applications to prevent obesity and keep fit.

After calculation of the two TPB models, both equations finally have only two independent variables that can predict the dependent variables. The independent variables, such as attitudes about the behavior and self-efficacy for exercise, can predict the dependent variable, or intention to exercise. But the two independent variables have a different influence on the intention to exercise.

The independent variables，such as self-efficacy for the use of health applications

and subject norms for the use of health applications can predict the dependent variable, or intention for the use of health applications, while the two independent variables have the opposite effect so that the result cannot explain which one has more influence on the respondents' intention.

Implication of Findings and Suggestion for Future Research

The purpose of this study is investigating the relationship between the exposure the smartphone health applications and the intention to use the applications to guide exercise behavior. From analyzing the data, it was found that health applications have a positive influence on the self-efficacy, subjective norms of the Chinese respondents. However，in this study participants displayed the important role of smartphone applications in supporting with health-related behavior change, some positive experiences of using such health applications, and willingness to try health applications, even though many of them did not know how to properly use health applications to guide their exercise behavior. Therefore, the researcher suggest application developers should create a video to explain the valuable information of the health application and teach viewers to use the health application prevent obesity and keep fit.

Firstly, this study illustrated that the health applications do have an effect on the Chinese respondents for the intention to use health applications and future actual behavior. But the final result does not describe how these smartphone applications impact the attitudes of the Chinese respondents' intention to use health applications, how these

health applications impact the self-efficacy, or the subjective norms of the Chinese respondents' intention to use health applications in a more detailed way. Further research can respectively investigate the change and improvement of the attitudes of the Chinese populations' intention to use health applications by questionnaire or interview to explore the confidence of the Chinese respondents toward using different types of health applications.

Secondly, one of the most notable findings of this research is that the exposure to health applications cannot predict the intention to use health applications for the Chinese respondents. Further research is needed to examine the actual reasons for this. Other variables of the TPB model including exposure to health applications, subjective norms for exercise and attitudes toward health applications, but these also cannot predict the intention of the participants. These independent variables are quite vital among the TPB model but this research shows that they cannot predict the intention to exercise and the intention to use health applications. Further research can continue to employ the variables of the TPB model to explore the effect on the health behavior of different populations and find out whether the results are consistent with the present study or not and future researchers can explore the reason why some of the independent variables can predict the intention while others cannot. The results of such research must have more practical significance.

Thirdly, from comparison, both equations have the independent variables that cannot

predict the intention of the TPB model. Subjective norms were not significant in the intention of exercise, but the relationship between subjective norms for using health applications and intention to use health applications is strongly predicted. Future research can employ different methods of research, such as recording or observing or interviewing for the same topic, to find out whether the result is consistent or not. The theory of planned behavior was intended to explain all behaviors over which people have the ability to exert self-control (Boston University School of Public Health, 2013). The key component of this model is behavioral intentions. Behavioral intentions are influenced by the attitude about the likelihood that the behavior will have the expected outcome and the subjective evaluation of the risks and benefits of that outcome. Future research can observe the targeted population's reaction from different dimensions and perspectives so as to achieve a more complete result.

It might also be interesting to run this same study again across cultures and more explicitly diverse age groups using a unique selection of health applications that target specific areas of interest to see how the statistical analysis and multiple regressions would compare both across cultures and across age groups.

It might also be interesting to run a similar study on groups with body dysmorphia issues, such as anorexia, bulimia, binge eaters, etc., to see how they would compare to this original research.

Limitations

The author has done a large amount of preparation and revisions for the research. However, there exist some deficiencies and imperfections in the experiment due to the time limitation. First of all, the author lists the questionnaire on the website so that most of the participants are students or workers and the ages of the respondents are about 18 to 29 years old. The young participants may have different viewpoints and confidence toward the health intention compared with the middle-aged population or elderly people. Young people may not care as much about their personal health due to the work pressure and time limitation and only some of the young ladies would have the intention to maintain their personal figure so that they would care about health and exercise. People who are elderly tend to pay more attention to personal health, nevertheless, they may not understand much about the applications on a smartphone and the usage of said applications. The results of a study including a wider age array would have been different and more comprehensive as well as more persuasive. Second, the theory of planned behavior is a time-consuming process in health exercise. It requires a long time to verify how effective the health applications would be. Furthermore, there might be other limitations in this study. For example, the subjects' of the research may not be fairly assessed by the questionnaire and just tick choices at random. All these inadequacies require more measurement and studies to improve.

Conclusion

The health applications for smartphones can provide convenience for Chinese as

shown in the analysis of the primary data. The smartphones have currently improved the behavior of human life, and users are able to search for information such as professional health advice through the use of wireless Internet. Users worldwide enjoy the improvement of the technology in our cell phones. The user's health and exercise also benefits from the applications on the smartphone so that the research investigates the effectiveness of health applications from the perspective of Chinese respondents. The theory of planned behavior predicts an individual's intention in a behavior at a specific time and place over which people have the ability to exert self-control (Boston University School of Public health, 2013). According to the theory of planned behavior, human behavior is associated with several psychological factors including exposure to health applications, attitudes toward the exercise behavior, attitudes toward using health applications, subjective norms for exercise, subjective norms for the use of health applications, self-efficacy for exercise, and self-efficacy for the use of health applications. The multiple regression findings showed that among the Chinese population a significant correlation existed among attitudes about health behavior, self-efficacy for exercise to intention to exercise, self-efficacy for using health applications, subjective norms for using health applications to the intention for the use of health applications. Suggestions for further research include exploring the influence of each factor for change and improvement in a more comprehensive way as well as the employment of other theories for the research method.

Appendix A

QUANTITATIVE QUESTIONNAIRE

1. Do you use a smartphone in your daily life?
   A. Yes
   B. No
2. Which of the following phone system do your use?
   A. Apple IOS
   B. Android
   C. Windows
   D. Others
3. How much time you spend on your smartphone every day?
   A. Less than once a day
   B. 1-2 times a day
   C. 3-5 times a day
   D. more than 6 times a day
4. How many applications in your smartphone?
   A. 1-5
   B. 5-10
   C. 10-15
   D. more than 15
   E. no applications
5. How do you think your personal figure?
   A. Underweight
   B. Normal weight
   C. Overweight
   D. Obesity
6. Please circle the applications (listed below) that you mostly use
   A. Game
   B. Photo &Video
   C. Music
   D. Traffic
   E. Weather
   F. Social networking
   G. Business
   H. Health &fitness
   I. Other
7. Have you ever used any health application in your smartphone?

A．I have used them.

B．I have heard them and would like to have a try

C．I have heard them but would not like to try them.

D．I have not ever heard them yet.

E. I would like to use them but I do not know how to use them.

8. Please circle the health applications (listed below) that you mostly use:

A. Health& fitness applications(such as Nike+running)

B. Health diet applications（such as: food calorie counter）

C. Healthy cooking/eating related applications（healthy recipes）

D. Other

Exposure to applications

9. Please check the applications that you use and that are related to walking/running in the following list

A. Nike Running

B. Runkeeper

C. Codoon

D. Endomondo Sports Tracker

E. Other

10. How many times do you spend using the walking/running related applications listed above?

A．1-2 times per week

B. 3-4 times per week

C. 5-6 times per week

D. more than 6 times a week

E. I do not use these applications

11. Please check the applications that you use and that are related to healthy eating in the following list

A. Yummly recipes

B. Nutrition Quiz

C. TwoGrabn

D. Calorie Counter and Diet tracker

E．Other

12. How many times do you spend using the healthy eating related applications listed above?

A．1-2 times per week

B. 3-4 times per week

C. 5-6 times per week

D. more than 6 times a week

E. I do not use these applications

13. Please check the applications that you use and that are related to weight loss in the following list

A. Lose it!

B. My Diet Coach

C. The Biggest Loser

D. 30 Days weight loss

E. Other

14. How many times do you spend using the weight lost applications listed above?

A. 1-2 times per week

B. 3-4 times per week

C.5-6 times per week

D. more than 6 times a week

E. I do not use these applications

Attitudes about the applications

15. These walking/running applications are good

A. Strongly disagree

B. Disagree

C. Neither disagrees nor agrees

D. Agree

E. Strongly agree

16. These healthy eating related applications are good

A. Strongly disagree

B. Disagree

C. Neither disagrees nor agrees

D. Agree

E. Strongly agree

17. These weight loss applications are good

A. Strongly disagree

B. Disagree

C. Neither disagrees nor agrees

D. Agree

E. Strongly agree

18. These walking/running applications are useful

A. Strongly disagree

B. Disagree

C. Neither disagrees nor agrees

D. Agree

E. Strongly agree

19. These healthy eating related applications are useful

A. Strongly disagree
B. Disagree
C. Neither disagrees nor agrees
D. Agree
E. Strongly agree

20. These weight loss applications are useful
A. Strongly disagree
B. Disagree
C. Neither disagrees nor agrees
D. Agree
E. Strongly agree

21. These walking/running applications are attractive
A. Strongly disagree
B. Disagree
C. neither disagrees nor agrees
D. Agree
E. Strongly agree

22. These healthy eating related applications are attractive
A. Strongly disagree
B. Disagree
C. Neither disagrees nor agrees
D. Agree
E. Strongly agree

23. These weight loss applications are attractive
A. Strongly disagree
B. Disagree
C. Neither disagrees nor agrees
D. Agree
E. Strongly agree

24. For me, using these walking/running applications is
A. Very unpleasant
B. A little unpleasant
C. Neither unpleasant nor pleasant
D. A little pleasant
E. Very pleasant

25. For me, using these healthy eating related applications is
A. Very unpleasant
B. A little unpleasant
C. Neither unpleasant nor pleasant

D. A little pleasant
E. Very pleasant

26. For me, using these weight loss applications is
A. Very pleasant
B. A little pleasant
C. Neither pleasant nor unpleasant
D. Unpleasant
E. Very unpleasant

27. For me, using these walking/running applications is
A. Very harmful
B. A little harmful
C. Neither harmful nor beneficial
D. A little beneficial
E. Very beneficial

28. For me, using these healthy eating related applications is
A. Very harmful
B. A little harmful
C. Neither harmful nor beneficial
D. A little beneficial
E. Very beneficial

29. For me, using these weight loss applications is
A. Very harmful
B. A little harmful
C. Neither harmful nor beneficial
D. A little beneficial
E. Very beneficial

30. For me, using these walking/running applications is
A. Very boring
B. A little boring
C. Neither boring nor fun
D.A little fun
E. Very fun

31. For me, using these healthy eating related applications is
A. Very boring
B. A little boring
C. Neither boring nor fun
D.A little fun
E. Very fun

32. For me, using these weight loss applications is

A. Very boring
B. A little boring
C. Neither boring nor fun
D.A little fun
E. Very fun

33. For me, using these running/walking applications is
A. Very unwise
B. A little unwise
C. Neither unwise nor wise
D.A little wise
E. Very wise

34. For me, using these healthy eating related applications is
A. Very unwise
B. A little unwise
C. Neither unwise nor wise
D. A little wise
E. very wise

35. For me, using these weight loss applications is
A. Very unwise
B. A little unwise
C. Neither unwise nor wise
D. A little wise
E. very wise

This section asks you to indicate how much you agree or disagree with the following statements. Each statement should be answered with this scale:

1=Strongly Disagree
2=Disagree
3=neither Disagree nor Agree
4=Agree
5=Strongly Agree

36. Having 3 times of 60-minute exercise a week makes me feel good every day._____
37. Having 3 times of 60-minute exercise a week prevents me to become sick.____
38. Having 3 times of 60-minute exercise a week prevents me to become obese.___
39. Having 3 times of 60-minute exercise a week keeps me fit. ____

Subjective norms

This section asks you to indicate how much you agree or disagree with the following statements. Each statement should be answered with this scale:

1=Strongly Disagree

2=Disagree

3=neither Disagree nor Agree

4=Agree

5=Strongly Agree

40. My family believes I should use running/walking applications to help me prevent obesity and keeping fit. ____
41. My family believes I should use healthy eating related applications to help me prevent obesity and keeping fit. ____
42. My family believes I should use weight loss applications to help me prevent obesity and keeping fit. ____
43. My family thinks it is fine for me to use running/walking applications to help me prevent obesity and keep fit. ____
44. My family thinks it is fine for me to use healthy eating related applications to help me prevent obesity and keep fit.___
45. My family thinks it is fine for me to use weight loss applications to help me prevent obesity and keep fit.___
46. My family believes I definitely should have at least 3 times of 60-minute exercise a week. ____
47. My family thinks it is fine for me to not have 3 times of 60-minute exercise every week. ____
48. My friends believe I should use running/walking applications to help me prevent obesity and keeping fit. ____
49. My friends believe I should use healthy eating related applications to help me prevent obesity and keeping fit. ____
50. My friends believe I should use weight loss applications to help me prevent obesity and keeping fit. ____
51. My friends think it is fine for me to use running/walking applications to help me prevent obesity and keep fit. ____
52. My friends think it is fine for me to use healthy eating related applications to help me prevent obesity and keep fit. ____
53. My friends think it is fine for me to use weight loss applications to help me prevent obesity and keep fit. ____
54. My friends believe I definitely should have at least 3 times of 60-minute exercise a week. ____
55. My friends think it is fine for me to not have 3 times of 60-minute exercise every week.

Self-efficacy

Items in the next section ask about your confidence that you could use health applications in various

situations. All the items should be answered with this scale:

1=Not at all confident
2=Not very confident
3=somewhat confident
4=Very confident
5=extremely confident

56. How confident are you that you can engage in using health applications regularly? ____
57. How confident are you that you can easily use health applications to help you keep fit? ____
58. How confident are you that you will always use health applications to guide you to prevent obesity? ____
59. How confident are you that you could have 3 times of 60-minute exercise a week even when you are tired that week? ____
60. How confident are you that you could have 3 times of 60-minute exercise a week when you feel you have not much time? ____
61. How confident are you that you could have 3 times of 60-minute exercise a week when you don't feel like to? ____

Intention

This section asks you to indicate how much you agree or disagree with the following statements. Each statement should be answered with this scale:

1=Strongly Disagree
2=Disagree
3=neither Disagree nor Agree
4=Agree
5=Strongly Agree

62. I intend to use health applications regularly for obesity prevention and keep fit over the next 6 months. ____
63. I intend to have 3 times of 60-minute exercise a week in the next 6 months. ____
64. Your age___?
65. Your gender:
    A. Male B. Female
66. Are you currently___?

A. Full-time student
B. Employed
C. Unemployed
D. Self-employed
E. Homemaker
F. Retired
G. Other

67. What is your education level?

A. Did Not Complete High School
B. High school
C. Some college
D. Bachelor’s degree
E. Master’s degree
F. PHD or higher
G. Other

68. What is your currently average income per month?

A. RMB 0-999
B. RMB1000-1999
C. RMB2000-2999
D. RMB 3000-3999
E. RMB 4000-4999
F. RMB 5000 or higher

Appendix B

UNIVERSITY OF HOUSTON

CONSENT TO PARTICIPATE IN A RESEARCH STUDY

TITLE OF THE STUDY: Investigating the Relationship between the Exposure to Smartphone Health Applications and the Intention to Use the Applications to Guide Exercise Behavior

INVESTIGATOR INFORMATION: This research study is directed by Xiaoqing Yang, University of Houston. This project is part of a M.A. dissertation and is being conducted under the faculty sponsor Dr Zhiwen Xiao.

Please read this form and ask any questions you may have before agreeing to be in the study.

PURPOSE: Obesity is one of the most rapidly increasing health issues right now; it will cause a lot of disease if people do not notice it. In order to reduce obesity problems, it is critical to increase individual's awareness of the risks related to the issue and, accordingly, create a platform for spreading health information. This spread of information can in turn generate substantial understanding amidst the public, as to select upon their daily intake and manage their weight gain efficiently. **The principle goal of this study is investigating the relationship between the exposure to smartphone health applications and the intention to use the applications to guide exercise behavior.**

LOCATION: This research study will use an online system, "SOJUMP" to deliver questionnaires to potential participants.

PROCEDURES: If you agree to take part in the study, you will be asked to complete a survey, which contains questions about demographics (e.g. age, gender, education, employment, income,); behaviors (e.g. smartphone use behavior) and so on. Sample questions include: "How many applications in your smartphone?", "How often do you use your smartphone?"" How often do you see the health messages?" "What kinds of health information do you like to see in the healthcare app?" The surveys will take about 30 minutes to complete.

CONFIDENTIALITY: Your participation in this project is confidential and your responses will remain anonymous**. All information collected from you during this study will be kept confidential. No names will be recorded in the survey or database.** Therefore, your identification will not be attached to any of the materials you complete

during the study. Only the researcher will have the access to your answers, which will be stored directly in a computer file that will not be connected to your name. No one else (including teachers, administrators and other students) will be able to see any of the answers you give. Data will only be used for research purposes.

RISKS AND DISCOMFORTS: **There are no direct risks and discomforts.**

BENEFITS: **There are no direct benefits**. The study will investigate whether smartphone holders' exposure to smartphone applications helps them obtain more knowledge related to obesity, produce positive attitudes towards obesity prevention, and create any intention to prevent the occurrence of obesity.

RIGHT TO REFUSE OR WITHDRAW: Participation in this study is totally voluntary. You may refuse to participate or withdraw at any time. You may also skip some of the questions. **ANY QUESTIONS REGARDING YOUR RIGHTS AS A RESEARCH SUBJECT MAY BE ADDRESSED TO THE UNIVERSITY OF HOUSTON COMMITTEE FOR THE PROTECTION OF HUMAN SUBJECTS (713-743-9204). ALL RESEARCH PROJECTS THAT ARE CARRIED OUT BY INVESTIGATORS AT THE UNIVERSITY OF HOUSTON ARE GOVERNED BY REQUIREMENTS OF THE UNIVERSITY AND THE FEDERAL GOVERNMENT.**

PUBLICATION STATEMENT: The results of this study may be published in professional and/or scientific journals. It may also be used for educational purposes or for professional presentations. However, no individual subject will be identified.

OFFER TO ANSWER QUESTIONS: If you have any questions about this study you may contact Xiaoqing Yang, the principal investigator, at xyang17@uh.edu. If you wish to talk to someone else or have questions about your rights as a participant, call the University of Houston Committee for the Protection of Human Subjects at (713) 743-9204.

Principal Investigator's Name:
____XiaoqingYang_____

Signature of Principal Investigator: _____

Appendix C

RECRUITMENT SCRIPT

Dear friends,

You are being kindly invited to participate in a research study conducted by Xiaoqing Yang, a graduate student in the Valenti School of Communication at University of Houston. This project is a part of my thesis work and only for the purpose of online data collection. I expect you understand English, and there is no need to translate recruitment material. My study is "Investigating the Relationship between the Exposure to Smartphone Health Applications and the Intention to Use Applications to Guide Exercise Behavior" among Chinese respondents, to increase their awareness of health problems, especially obesity. Sample questions include "Do you use healthcare applications in your smartphone?" "Do you like to pay some attention to see some healthcare information by smartphone?" "What kinds of health information do you like to see in the healthcare app?" "Do health applications help you solve some health problems?"

This project has been reviewed by the University of Houston Committee for the Protection of Human Subjects (713) 743-9204.

Obesity is one of the most rapidly increasing health issues right now; it will cause a lot of diseases if people do not notice that. In order to reduce obesity, it is critical to increase individual's awareness of the risks related to the issue. As a result, creating a platform for spreading health information is very necessary. In terms of the research, its aim is to prove that smartphone applications have effect on individual's health-related attitudes and behaviors with regards to the issue of obesity. You will be one of approximately 300 participants to be asked to participate in this study. I kindly invite you to complete an online survey, which takes you 30 minutes. Your response is important to me and may help me better understand smartphone users' attitudes towards and intentions on implementing the advocated practices suggested by smartphone applications to prevent obesity.

The whole study is totally voluntary and you may refuse to participate or withdraw from it at any time without penalty. You may also refuse any questions. Your participation in this project is confidential and your responses will remain anonymous.

Xiaoqing Yang
xyang17@uh.edu
Thank you for your participation!

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