

# Health self-monitoring devices adoption in China: a modified model theory of Technology Acceptance Model

## Abstract

The 2019 Corona Virus (COVID-19) has spread rapidly in China. Patients who reported pre-existing chronic disease conditions had fatality rate of up to 9.6%, compared with patient without pre-existing chronic condition. In addition, epidemiological trends in the last decade have shown a significant increase in the burden of chronic illnesses in China. Thus, more attention is being directed to technologically supported health self-management and lifestyle change in order to assist patients monitor and manage their own conditions. In this current era, it has become prevalent for Chinese consumers to utilise digital monitoring devices to undertake self-monitoring requirements to control and prevent chronic disease. In order to promote material of these devices to be effective, it is critical to understand the behavioural of Chinese patients' intention to use the devices for measuring, storing and managing their own health data. As such, the purpose of this paper is to explore the factors affecting the acceptance and adoption of digital health self-monitoring applications from the perspective of Chinese patients. Theoretical underpinnings shall consist of applying the Devices Acceptance Model (TAM). Furthermore, social and cultural factors shall be taken into account to due to the complexity of the collectivist Chinese culture.

**Key words:** chronic disease self-monitoring, chronic disease prevention, health self-monitoring devices, corona virus 2019, devices acceptance model, Chinese social variables and culture

## 1.0 Background

The 2019 Corona Virus (COVID-19) has spread rapidly since its recent identification in patients with severe pneumonia in Wuhan (China Li and De Clercq 2020) in December 2019. As of 28 February 2020, 2019-nCoV has been reported spread in 36 countries and >82,000 cases have been confirmed, with an estimated mortality risk of ~2% (National health commission of the People's Republic of China, 2020). There were 2747 patients who died in China, by the time of this publication (National health commission of the People's Republic of China, 2020). However, World Health Organization (WHO) states that older people, and people with pre-existing medical conditions (such as diabetes and heart disease) appear to be more at risk of developing severe disease (WHO, 2020). Patients who reported no pre-existing "comorbid" medical conditions had a case fatality rate of 0.9%. Table 1 indicates the death rate of patients with different pre-existing conditions (which are also chronic disease), the patients with pre-existing illnesses are more likely to have higher death rate due to COVID-19. As shown in Table 1, the death rate of patients with chronic disease conditions are 5-10 times higher than the death rate of patients without chronic disease (National health commission of the People's Republic of China, 2020). In addition, the most intractable challenge faced by health sector globally is the death rate. Chronic diseases such as heart disease, chronic respiratory illness, and diabetes are by far the leading cause of death, topping most all-cause morbidity lists globally (WHO, 2020). By 2020, 70% of adults will have been diagnosed with at least one chronic condition. (WHO, 2020). Therefore, it is imperative for residents to prevent the chronic disease in advance. The phenomenon of digital health self-monitoring devices has emerged as key solutions of chronic disease prevention (Alam et al., 2020). Because these devices enhanced health promotion, behaviour changes support self-management of chronic diseases. (Shan, Sarkar and Martin, 2019). For example, diabetes mellitus is a disease that can be difficult to manage and requires high levels of health literacy and numeracy, self-monitoring and frequent contact with clinicians. If not optimally controlled, diabetes can lead to kidney failure, blindness and cardiovascular complications, which, in turn, contribute to increasing healthcare costs (Shan, Sarkar and Martin, 2019). However, the application of digital health self-monitoring devices could solve these problems. As a result, government spends 80% of total health care expenditures for chronic disease devices adoption, which still exist the low acceptance rate towards the digital health self-monitoring technologies (Alam et al., 2020). In order to improve and predict the acceptance rate, the most essential factor is to attract and keep their users, precipitating the understanding on users' mobile health service adoption behaviour.

<b>PRE-EXISTING CONDITION</b>	<b>DEATH RATE</b>
<b>Cardiovascular disease</b>	10.5%
<b>Diabetes</b>	7.3%
<b>Chronic respiratory disease</b>	6.3%

<b>Hypertension</b>	6.0%
<b>Cancer</b>	5.6%
<b>No pre-existing conditions</b>	0.9%

Table 1: COVID-19 Fatality Rate by COMORBIDITY

In this developing paper, we propose to make a conceptual contribution towards the understanding of Chinese users' perceptions of digital health devices as related to their intentions to use these devices to prevent chronic diseases in future. We integrate the original Technology Acceptance Model (TAM) with factors that cause social change in today's society, i.e. trust in social media (particularly via electronic word-of-mouth practices) and conformity.

## 2.0 Literature Review and Theoretical Background

The Technology Acceptance Model (TAM) is a well-known theory in order to predict the user's acceptance rate. TAM suggests that perceived usefulness (PU) and perceived ease of use (PEOU) are the user's perceived view of new technology, which will determinate their intention to use. TAM was first developed within the context of information technologies, particularly investigating the use of computers by employees. In that context, this model included four constructors: perceived usefulness (PU), perceived ease-of-use (PEOU), intension to use and actual use (Davis et al. 1989) Davis et al. (1989) defined perceived usefulness (PU) as "the degree to which person believes that using a particular system would enhance his or her job performance", and perceived ease-of-use (PEOU) as "the degree to which a person believes that using a particular system would be free from effort".

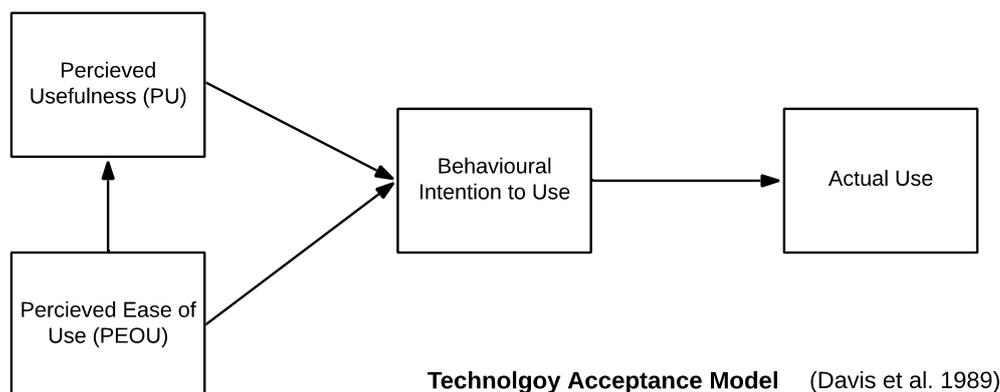


Figure 1: Technology Acceptance Model (TAM)

Source: *Davis et al. 1989*

## 2.1. Technology Acceptance

Technology acceptance is the priority for each emerging technology adoption (Davis, 1989). It engages in understanding the variety of factors that determine users' intentions to adopt a technology and their actual technology usage behaviours. TAM is seen as a commanding theoretical model proposed to predict or forecast the acceptability variables of technology, the causative items that will influence an individual to adopt certain technology. In addition, Technology Acceptance Model (TAM) has been utilized in technology-related studies across various disciplines, particularly in social sciences, educations and management researches. An increasing number of research modified and implemented TAM in different fields: E-learning (Farahat 2012), E-shopping (Lim and Ting 2012), E-health (Marhefka et al. 2018), taxi-hailing app (Suhud et al., 2019), mobile health App (Jan et al., 2019), health smart watch (Dutot, Bhatiasevi and Bellallahom, 2019), Uber App (Min, So and Jeong, 2019), mobile payment (Li et al., 2019). The developed TAMs achieved decent acceptance rate in the corresponding application. However, TAM has still few limitations: (1) the current TAM is not comprehensive, extended should be added based on specific implementation field (Suhud et al., 2019). Although TAM is widely accepted and adopted by researchers, others also condemn and disregard it for not taking into account other cognitive practice to end user behavioural choices. (2) In order to apply TAM in different specific research contexts it should include cultural or social characteristics of users. However, Ye et al. (2019) argue that because of the simplicity of the model, it is easy and simple to predict the actual usage. Bobitt et al., (2019) explored that TAM model was more appropriate for individual use and acceptance of technology rather than in a corporate or institutional application that requires integration of information technology. Various previous studies applied TAM in institutional application (Alam et al., 2020; Min, So and Jeong, 2019; Suhud et al., 2019). At the same time, the research related with individual use of the technology is still confined to the views of experts as technology user, not the citizen users. For example, in the field of health self-monitoring devices, despite numerous previous studies investigating the electronic health devices adoption behaviour, most of these studies view this phenomenon from the perspective of professionals or physicians (Bhattacharjee et al. 2017, Chau et al. 2012, Klein 2018), focusing on the technologies used in the diagnosis process (Romanow et al. 2019) such as electronic medical records (Hennington et al. 2017) and computerized physician order entry (COPE) systems (Bhattacharjee et al. 2017). In contrast, the studies on health devices adoption behaviour from the perspective of patients or consumers are relatively rare. This lack is a mismatch for the increasing prevalence of health devices or services for consumers who receive medical care (Or et al. 2019). Thus, this study fills the gap by examining the health devices acceptance behaviour from the perspective of consumers rather than that of professionals.

### 3.0 The Integrative Model

Based on the research gap and in the light of recent events involving rapid spread of Covid-19 virus, this paper aims to develop a research model to predict the actual use of health self-monitoring technologies in China particularly to prevent chronic disease in Chinese residents. This paper will apply the TAMs and considered Chinese culture or social factors: trust in social media and conformity, which played an essential impact on Chinese people' intention to use.

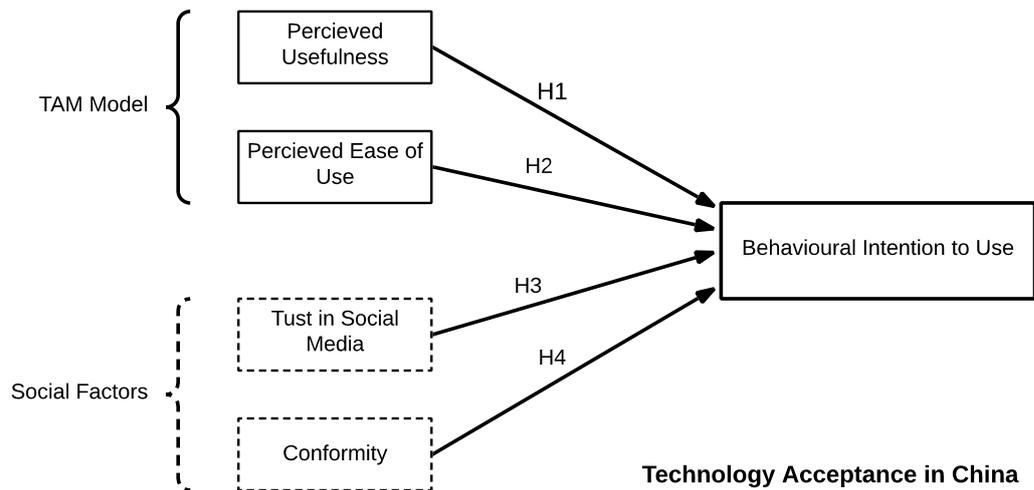


Figure 2: Research Model: Technology Acceptance in China

Table 2:

Construct Definitions

Construct	Definition
Perceived Usefulness	The degree to which a person believes that using health self-monitoring devices would enhance user's job performance. (Davis, 1989)
Perceived Ease of Use	The degree to which a person believes that using health self-monitoring devices would be free from effort. (Davis 1989).
Trust in Social Media	The measurement of the trust of social media based on health self-monitoring devices sources followed previous studies on how individuals evaluated the trustworthiness of health self-monitoring device online (Richardson et al., 2012).
Conformity	Conformity as an individual's change in product evaluation and purchase intention according to group's evaluation and purchase intention towards digital health self-monitoring devices (Zinkhan 1999)

Abiding by original TAM's propositions we also propose:

H1: Perceived usefulness of the digital health self-monitoring devices has positive impact on individual's behaviour intention to use digital health self-monitoring devices.

H2: Perceived ease of use of the digital health self-monitoring devices has positive impact on individual's behaviour intention to use digital health self-monitoring devices.

### 3.1 Trust in social media

The level of trust in social media has been found to be an important predictor of online buying behaviour, as trust reduces perceived risks and costs associated with reliability or functionality of the health related self-monitoring devices (e.g. mobile apps, glucometers etc.) (Chen&Sharma, 2019). Existing research has shown that Internet users trust in social media strongly influence individuals' buying behaviour (Serdamba and Erdenebileg, 2019). In a similar vein, scholars discovered that health-related issues was promoted by trust, a feeling of safety (Zolowere et al., 2018). A study carried out in rural China suggested that trust was rated as the first reason for people to disclose sensitive issues, followed by a feeling of needing help. Second, while it is generally believed that the information provided on social media by peers, rather than by medical experts, might be misleading and less trustworthy (Pant et al., 2012), our study suggests that trust in social media-based information is significant predictor of further health-related behavioural engagement. Earlier studies found that peer-to-peer videos were more effective in influencing peoples' attitudes and issue importance (Paek, Hove, Jeong,&Kim, 2011). However, Vraga and Tully (2019) argued that this constructor does not wide applicability. Based on the culture differences, different countries show different index toward trust in social media. 2018 Edelman Trust Barometer Global Report (Suanders et al., 2018) indicates the different data from the percentage of their population who trust in social media between different countries. The data from China rule the roost, which was 71%. Compared with 31% in UK, the evidence proved that social media strongly influence on Chinese residents. Therefore, social media play an essential royal in Chinese society and influenced on customer buying behavior as well.

Based on these arguments, this paper proposes:

H3: Trust in social media positively impacts on individual's behaviour intention towards digital health self-monitoring devices.

### 3.2 Conformity

In social psychology, the notion of social conformity was originally formulated as deference to the socially approved norm (Asch, 1955) and was viewed as one possible response to social influence (Asch, 1956). When people are free to do as they please, they usually imitate each other.(Hoffer, 1955).Conformity behaviour describes social situations in which individuals are strongly influenced by the decisions of others (Asch, 1956). Conformity has been demonstrated in a number of studies on customer buying behaviour/health related behaviour(Lindquist, Smusz and Doerner, 1985), (Oh, Youl-Gun, 2016),(Arnold et al., 2019)(Monks et al., 2019). In terms of the research area of health and buying behaviour, Reid et al.,(2019) proposed that the personal health related buying behaviour

(consume alcohol and eat unhealthily) been strongly influenced by peer behaviour which can be regarded as conformity. Laghi et al.,(2019) explored that conformity motivates the heavy episodic drinking behaviour among adolescents. Constant et al.,(2019) also emphasized that social conformity influenced the human decision making when they make consumption of health related devices.

The existing literature and theoretical accounts suggest that conformity behaviour can satisfy individual's social affiliation and accurate decision-making (Chartrand & Lakin, 2013; Cialdini & Trost, 1998). However, due to cultural differences, people from different countries behave differently and have been influenced by social conformity as framed by different contexts (Meade and Barnard, 1973). Specially in terms of buying behaviour, conformity strongly impacts Chinese group's customer behaviour (Qureshi and Malik, 2017). The existing literature separately explores how conformity influences health related behaviour and customer buying behaviour. Preventing the chronic disease using health self-monitoring devices can be regarded as the health behaviour change. Therefore, this paper proposes the hypothesis below:

H4: Conformity positively impacts on individual's behaviour intention towards digital health self-monitoring devices.

#### 4.0 Conclusion

This paper aimed to synthesize current literature on TAM implemented in health self-monitoring devices and extend it to involve the influences of social or cultural factors towards predicting and better understanding of user's acceptance rate. Today, digital health self-monitoring devices possess enhanced functions to help prevent chronic diseases and monitor daily health condition. Therefore, the potential increased acceptance rate will contribute to healthcare provider and governments' obligation of chronic disease management. Implementation of policies to this respect will not only reduce the total chronic disease expenditure, but also reduce the potential death rate. Due to the recent emergence of COVID-19 in China and its fast spread throughout the world, disease prevention policies can have remarkable impact on human lives and digital health monitoring devices are useful tools to implement such policies effectively. However, users' expectations are crucial in mass uptake of these devices. This paper aimed to respond to this gap by employing TAM model and extending it further to encompass issues such as trust and conformity specifically in the Chinese social and cultural context.

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