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Consumer Adoption of Health Information Systems

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Consumer Adoption of Health Information Systems

Consumer Adoption of Health Information Systems

A dissertation submitted in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy in Business Administration

by

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ABSTRACT

At nearly 18 percent of the country's GDP, the U.S. healthcare industry continues to wrestle with growing cost and a quality of care that does not match the increased spending. The dominant focus to date has been on promoting Health IT (HIT) system implementation and digitizing health records at the provider's end, with scant attention to the role of the patient in the healthcare process. The source of inefficiency in the healthcare system is not only on account of shortcomings at the provider's end but also due to non-compliance (such as failing to adhere to medication advice and follow-up visits) at the patient's end. Because of this two-fold inefficiency, recent focus has been on engaging the patient to jointly work with the physicians in managing their health and wellness.

There are several health related IT applications (popularly called as *health apps*) and online health communities directly targeted at the consumer for aiding self-management of one's health and wellness. However, widespread adoption and usage of these systems by consumers is yet to happen, which underscores the need for a systematic study to identify the factors that drive consumer adoption and usage of these HIT systems.

This dissertation focuses on the mechanisms underlying consumer adoption and usage of HIT systems through three essays. Together the three essays advance our knowledge of the factors that underlie consumer adoption and usage of HIT systems and the interventions through which adoption and usage of these systems can be further enhanced. The theoretical and practical implications of the findings and directions for future research are discussed. Future research that builds on the findings of this dissertation research will not only advance theory but also significantly impact policies that guide IT driven consumer health and wellness initiatives.

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DEDICATION

Dedicated

in memory of my

paternal grandparents *Vaidyanathan & Jayalakshmi* and uncle *Natarajan*

maternal grandparents *Naganathan & Parvatham* and aunt *Meenakshi*

at the lotus feet of

Bhagavan Shri Sathya Sai Baba

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INTRODUCTION

“One of the most underused resources in healthcare in America is the consumer”

Carolyn Clancy, Director, AHRQ

The U.S. healthcare industry continues to wrestle with the growing cost and a quality of care that does not match the increased spending. At nearly 18 percent of the country’s GDP (Fuchs 2013; Pricewaterhouse Coopers 2005), the U.S. healthcare accounts for a significant portion of the nation’s expenditure; however, the quality of care is low. According to the Institute of Medicine, there are nearly 100,000 deaths every year in the U.S. due to preventable errors alone, and a recent report puts the cost of these errors at \$ 3.5 billion every year (New York Times 2006). To repair this large-scale inefficiency in the healthcare system and to enhance the quality of care, the U.S. government has been advocating for a technology driven transformation of the healthcare system. Through acts such as the Health Information Technology for Economic and Clinical Health (HITECH), the federal government has budgeted billions of dollars in incentives to drive adoption and meaningful usage of these electronic health systems. Besides, through the Office of the National Coordinator for Health Information Technology (ONCHIT) the federal government also monitors the deployment and usage of Health IT systems across the nation.

The dominant focus to date has been on promoting Health IT (HIT) system implementation and digitizing patient health records at the provider’s end, with scant attention to the role of the patient in the healthcare process. The source of inefficiency in the U.S. healthcare system is not only on account of shortcomings at the provider’s end but also due to non-compliance (such as failing to adhere to medication advice and follow-up visits) at the patient’s end. Because of this two-fold inefficiency, recent consensus has been on engaging the consumer

(patient) to jointly work with the physicians in managing their health and wellness. In addition to engaging the patients, there have also been calls to empower them by giving them access to their health and treatment related information (e.g., Blue Button initiative), which have to date resided with the provider. As a way of enhancing consumers' access to their health related information, the ONCHIT has included *active electronic patient engagement* as one of several criteria to demonstrate *meaningful usage*, which hospitals must comply with to be eligible for reimbursements and to avoid penalties. There are also several health related IT applications (popularly called as *health apps*) directly targeted at the customer for aiding self-management of one's health. Thus, one might expect that there would be rapid adoption of such systems as they empower the customer in managing their health and wellness. However, quite paradoxically, widespread adoption of CHIT is yet to happen (e.g., Assadi and Hassanein 2009); which underscores the need for a systematic study to examine the factors that drive consumer adoption of these HIT systems.

This dissertation focuses on the mechanisms underlying consumer adoption and usage of HIT systems through three essays. Table 1 outlines the organization of the essays.

Table 1. Organization of the Essays

ADOPTION OF HIT SYSTEMS		USAGE OF HIT SYSTEMS
<i>Essay 1</i>	<i>Essay 2</i>	<i>Essay 3</i>
What mechanisms underlie consumer adoption of Health IT systems?	What interventions can drive consumer adoption of Health IT Systems?	What effect does system design have on usage post adoption? (in the context of online patient communities)

Essay 1 develops a model to explain consumer adoption of health apps. In the context of consumer health technologies, current technology acceptance theories must be expanded to include not only the technology related beliefs but also health related beliefs and other relevant factors associated with using the technology to manage health and wellness. This research builds on two well-established theories from the health sciences and the information systems disciplines, the Health Belief Model (HBM) and the Technology Acceptance Model (TAM), and integrates them by drawing on recent research on consumer acceptance of technology (UTAUT2) to study consumer adoption of mobile health apps. This research extends our knowledge of user acceptance of technologies to a consumer healthcare context.

Building on the findings from *Essay 1*, *Essay 2* focuses on the role of interventions in driving consumer adoption of health apps. Consumer adoption of HIT systems continues to lag despite significant improvement in accessibility and affordability of these systems. Hence, there is a need for a systematic study to better understand interventions that can drive adoption of these systems. Recent IS research (Angst and Agarwal 2009) suggests that intervention strategies that promote the benefits (positive aspects) of a system could be used to influence consumer attitude and in turn drive user adoption intentions of HIT. There is also an emerging stream of literature that shows that people attach importance to user reviews (word of mouth information) and that it can significantly impact user attitudes, intentions and even actual behavior. Against this backdrop, this research examines the interplay between firm generated message (to promote HIT adoption) and word of mouth message on user adoption intentions of health applications. This research builds on the message framing, word of mouth, processing fluency and trust streams of literature.

Essay 3 focuses on understanding how usage of the HIT system can be furthered in a post-adoption setting. This study considers a particular type of HIT, online patient community (OPC). OPCs are online communities that bring patients with similar conditions together to foster dialogue and exchange of social support. Because of the sensitivity associated with health information, fostering active collaboration among the OPC members is a challenge. Given the heightened focus on *empowering consumers* and granting them control over their health information, this research examines the impact of providing user control over one's identity on the usage of the OPC system - in terms of the amount of health related support shared and sought. This research builds on the social loafing and silence literature streams, and argues that making the community either non-anonymous or anonymous would be detrimental to foster active collaboration. Allowing users to be anonymous or identified (non-anonymous) at their own preference, this essay argues, would lead to the optimal amount of collaboration.

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ESSAY 1: CONSUMER ADOPTION OF HEALTH INFORMATION TECHNOLOGY: A STUDY IN THE CONTEXT OF MOBILE HEALTH APPLICATIONS

ABSTRACT

In the context of consumer health technologies, current technology acceptance theories must be expanded to include not only the technology related beliefs but also health related beliefs and other relevant factors associated with using the technology to manage health and wellness. This research builds on two well-established theories - the Health Belief Model (HBM) and the Technology Acceptance Model (TAM) - and integrates them by drawing on recent research on consumer acceptance of technology (UTAUT2) to develop a model of consumer adoption of mobile health applications. Results show that *perceived usefulness*, *hedonic motivation*, *facilitating condition* and *social influence* are key predictors of the *intention to adopt* mobile health applications. Also, *self-efficacy* (of managing health) was found to influence perceptions of ease of use of the health application. Interestingly, *health motivation* of an individual had a significant influence on perceptions of usefulness of the application whereas, *perceived health threat* did not. The proposed model was tested among members of an online consumer panel (n=391). The model could explain about 62 percent of variation in the intention to adopt the health application. The implications of the research findings for research and practice are discussed. This research extends our knowledge of user acceptance of technologies to a consumer health IT context.

INTRODUCTION

Consumer health IT (CHIT) refers to the “*collection of tools, technologies and artifacts that consumers can use to support their healthcare management tasks*” (AHRQ 2009). For example, consumers can use health IT (HIT) tools such as *mobile health applications* to monitor their physical activity and calorie intake; *personal health records* to document their health and treatment related data; *health portals* to securely access their health related information and to schedule appointments; *health information websites* to learn about disease and treatment options; *health communities* to interact with others with similar ailments or expertise for seeking support; and *health monitoring devices* to measure body vital parameters. Refer to Table 1 for a representative example of IT tools for each type of CHIT.

The classification of CHIT systems in Table 1 was prepared by synthesizing prior literature, trade press articles and the information from the website of Office of the National Coordinator for Health IT (ONCHIT). Prior research suggests that when consumers self-manage their health, there can be positive impacts on health outcomes (Heisler et al. 2002 p.243). In addition, the federal government has been emphasizing on using IT systems to engage and empower consumers to help them take charge of their health and wellness activities (AHRQ 2009) as one way of overhauling the healthcare system. On account of the widespread availability of mobile devices (Demiris et al. 2008; Patrick et al. 2008) and internet connectivity, there is a growing interest in using mobile based health applications to engage consumers in their health management. *Mobile health applications* refer to software programs that reside on mobile devices, which can assist customers with their health and wellness management activities. For example, hospitals like *Kaiser Permanente* provide mobile health applications that send appointment reminders, health tips and customized health alerts; the hospital provided

application can also enable patients to securely login to the hospital’s portal to access health records, contact providers, order prescription refills and schedule appointments.

Table 1. Classification of CHIT Systems

Type of CHIT	Description	Representative Examples
Mobile Health Applications	Software programs that can be installed on mobile devices to track and manage health, wellness and physical activities	Runkeeper (<i>Private</i>) Preventive Care App (<i>Hospital-KP</i>) Text4baby (<i>Government</i>)
Personal Health Records	Electronic systems that let individuals to document their health related information longitudinally that can then be integrated with electronic health record in hospitals	Microsoft HealthVault (<i>Private</i>) VHA’s MyHealthetvet (<i>Government</i>)
Health Portals	Electronic systems provided by hospitals to facilitate scheduling visits, ordering refills, and communicating securely	Kaiser Permanente’s (<i>Hospital-KP</i>) HealthTrak (<i>Hospital-UPMC</i>)
Health Websites	Repositories of health, wellness and treatment related information for reference	WebMD (<i>Private</i>) health.nih.gov (<i>Government</i>)
Online Patient Communities	Platforms for patients to engage with similar others for informational and social support	PatientsLikeMe.com (<i>Private</i>) Acor.org (<i>Private</i>)
Monitoring Devices	Physical devices used to monitor health condition and vital parameters	iHealth WeightScale (<i>Private</i>) FitBit aria Wi-Fi smartscale (<i>Private</i>)

The federal government has also been contributing to the development of health applications through its annual application development contest *Health Datapalooza*. Also, many insurance companies are planning to launch mobile applications to help customers manage their health care and insurance related activities (Insights Healthcare 2012). In addition to the health applications offered by institutional and government agencies, there is also a plethora of health and wellness applications developed by software firms and independent developers; there are

more than 13,000 health and fitness applications for the iPhone alone (Consumer Health News 2012) in Apple's App Store marketplace.

Considering that the U.S. healthcare industry accounts for nearly 18 percent of the nation's GDP (Fuchs 2013), even small improvements in the population's overall health and wellness can help avoid unnecessary hospital visits and admissions, helping save billions of dollars. Hence, even simple health applications like those that help track calories consumed or any abnormality in sleep patterns can go a long way in both improving the health outcomes for the individual as well as in affecting the national expenditure on healthcare. However, for this improvement to result, consumers must use these systems. Despite the rapid proliferation of HIT tools that seek to put patients in control of their health information and management, widespread adoption is yet to happen (e.g., Assadi and Hassanein 2009). Also, the lackluster performance of consumer IT leaders Google and Microsoft with their consumer health IT offerings suggests that consumer health IT space may be unique and that knowledge from other consumer IT domains may not readily extend to it. Considering the time and resources invested in making the health applications already available in the market and the fact that several new health applications¹ are being developed, there is an urgent need to identify the factors that drive consumers to adopt these systems. User non-acceptance can undermine the potential benefits that the U.S. healthcare system as a whole can reap in terms of efficient and enhanced care. Thus, research that examines the factors that drive consumer acceptance of health IT systems, such as mobile health applications, is of high and immediate practical relevance. Knowledge from such research would help inform system design to achieve user adoption and avoid failure.

¹ <http://rockhealth.com/resources/digital-health-startup-list/>

There is a rich stream of IS research that has examined the influence of Health IT (HIT) technologies on hospital performance. This stream of research can be classified as those that have studied the impact of HIT use on downstream performance and those that have studied the issues related to the adoption of HIT systems (Agarwal et al. 2010). This body of research has shown that use of IT in hospitals can enhance quality of service (e.g., Devaraj and Kohli 2000, 2003), patient safety (e.g., Aron et al. 2010), increase revenue (e.g., Menon et al. 2000), enhance profitability (e.g., Devaraj and Kohli 2000), and lower costs (e.g., Menon and Lee 2000). Also, recent research at the individual level, studying factors such as physician resistance to HIT systems, has shown the influence a medical staff's network position can have on their usage of such systems (e.g., Kane and Labianca 2011; Venkatesh et al. 2011). By focusing beyond the predominantly macro level issues (Venkatesh et al. 2011), this emerging body of IS research has served to advance our understanding of issues surrounding medical personnel adoption and usage of HIT systems. In one of the first studies on HIT systems at the consumer level, Agarwal and colleagues examined the role of privacy in influencing consumer willingness to allow their health information to be digitized (Angst and Agarwal 2009) and in sharing their health information with various stakeholders (Anderson and Agarwal 2011). Other research has considered the factors that drive individuals to disclose health information to websites (e.g., Bansal et al. 2010). While this emerging research stream has greatly helped the IS field to initiate theory-driven rigorous research on consumer health IT systems, the fundamental question *what drives consumers to adopt Health IT systems* remains unanswered. The focus of this essay is to examine the factors that underlie consumer adoption of health IT systems in the context of mobile health applications. In doing so, this research also answers the recent call by scholars to study issues surrounding consumer adoption of health IT systems (Agarwal et al. 2010).

I use the Health Belief Model (HBM) (Rosenstock 1974) from the health sciences literature as the framework and integrate it with the technology adoption model (TAM) (Davis 1989) to further our understanding of the adoption of HIT systems. HBM is particularly relevant to study consumer adoption of mobile applications for health and wellness management because HBM was developed to explain health related behavior such as undertaking cancer screening (Becker 1974). Over the last several decades, HBM has been used to understand variety of healthful behaviors (Carpenter 2010). Besides, it has also been used to understand non-health behaviors such as intentions to emigrate (Groenewold et al. 2006). Recently, IS scholars used this theory to understand computer security behavior (Ng et al. 2009) and support seeking behavior in online health community (Liu and Chan 2010). Hence, I consider HBM to be an appropriate lens to understand consumer adoption of health applications to manage their health and wellness activities. I integrate HBM with the technology acceptance model (TAM) (Davis 1989). TAM is particularly relevant to the current context because TAM has a history of being successfully employed in the health sciences literature (Holden and Karsh 2010) to explain adoption of health IT systems in hospitals. A recent review by Holden and Karsh (2010) on the role of TAM in healthcare refers to it as the “gold standard” (p.159) and calls for future research in health IT adoption to build on TAM by contextualizing it to the healthcare domain. This is because TAM does not have the necessary contextual variables to account for a specialized domain such as healthcare. Also, recent IS research has examined the factors underlying consumer adoption and usage of IT (UTAUT2) (Venkatesh et al. 2012) by extending the UTAUT model (Venkatesh et al. 2003) with additional relevant constructs such as habit, price value and hedonic motivation. Building on the findings of UTAUT2 is relevant to the current context because mobile health applications are essentially health related IT services. Hence, I

draw on UTAUT2 to identify additional important variables to include in the HBM-TAM model that can help us explain consumer adoption of mobile health applications better.

This research makes several key contributions to the literature. By integrating two well-established theory streams, HBM and TAM, this research advances our knowledge of factors that drive consumer adoption of health IT. Also, by integrating HBM with TAM using theory-driven arguments, this research accounts for the intervening mechanisms through which the health belief variables affect one's health related behavior. Seen another way, this research proposes health related antecedents to the TAM constructs. In so doing, this research also answers the call in the literature to better understand the issues around consumer acceptance of HIT systems. Finally, this is also one of the first IS research studies to integrate UTAUT2 with the HBM and also UTAUT2 with the TAM. In doing so, this research also extends UTAUT2 to a consumer health IT context. In the following sections, I present the theoretical background, the research model, hypotheses, the methodology adopted to test the hypothesized relationships, results and implications for research and practice.

THEORETICAL BACKGROUND

In this section, I present an overview of the Health Belief Model, Technology Acceptance Model and relevant constructs from UTAUT2 that are used in building the research model.

Health Belief Model

The Health belief model (HBM) is a widely used model of health behavior (Carpenter 2010; Janz and Becker 1984; Strecher et al. 1997), originally developed in the health sciences to understand failure to adopt preventative health measures (Rosenstock 1966) such as tuberculosis screening (Hochbaum 1958). The ability of the model to “explain and predict” (Walker and Thomas 1982 p. 187) adoption of health behaviors (Carpenter 2010) has led to its usage to

predict a wide range of behaviors (Abraham and Sheeran 2005; Walker and Thomas 1982). Besides, it has also been used to design interventions to influence behaviors (Sohl and Moyer 2007; Strecher et al. 1997). In IS research, the HBM model has been applied to study computer security behavior (Ng et al. 2009), as securing one's computer is similar to protecting one's own health. The HBM posits, the perceived susceptibility to an ailment, perceived severity of the ailment, perceived barriers such as cost/pain associated with engaging in the behavior, perceived benefits of the recommended behavior in containing the ailment and cues to action (which drive the individual to engage in the behavior), as factors that influence an individual to engage in a healthful behavior (Carpenter 2010). Subsequently, additional variables such as health motivation (general health orientation) (Becker 1974) and self-efficacy (Rosenstock et al. 1988) were also proposed to be part of the HBM model. Health motivation (health orientation) refers to "the individual's predisposition or habit concerning health seeking behavior in general" (Walker and Thomas 1982, p. 188). Self-efficacy (Bandura 1977) in a health context refers to the confidence in one's ability to engage in a healthful behavior (Rosenstock et al. 1988). Perceived susceptibility and perceived severity jointly form the perceived threat associated with the ailment and this perceived threat is proposed to predict the likelihood of healthful behavior (Strecher et al. 1997). That is, it is not the probability of falling ill or the severity of falling ill alone, but the combined effect or the severity of the susceptibility which will pose the threat to take action. Perceived threat is also used in other health models such as protection motivation theory (Rogers 1975). There have also been calls to look at the potential mediation and moderation among the HBM variables (Carpenter 2010; Strecher et al. 1997). In particular, a meta-analysis on studies that employed health belief model has found perceived barrier to be a key predictor of health behavior (Carpenter 2010). Unlike perceived health threat, health motivation and health

management self-efficacy, which are based on the individual and their health, perceived barriers, perceived benefits and cues to action can vary as a function of the context or the nature of the technology used. Hence, I draw on relevant prior research to account for these dimensions of the health belief model. In other words, I identify relevant *constructs* to represent these *concepts*.

Technology Acceptance Model (TAM)

The technology acceptance model (TAM) (Davis 1989) is a well-established model of user adoption of IT systems, originally proposed to predict acceptance of IT systems on the job. The TAM posits that an individual's intention to adopt an IT system is a function of his or her technology related beliefs, namely perceived usefulness and perceived ease of use (Davis 1989). Perceived usefulness is defined as *"the degree to which a person believes that using a particular system would enhance his or her job performance"* (Davis 1989 p. 320). Perceived ease of use is defined as *"the degree to which a person believes that using a particular system would be free of effort"* (p.320). Over the years, TAM has been validated by several research studies (e.g., Venkatesh 2000; Venkatesh and Davis 2000) and applied in various contexts and research streams outside including healthcare (Holden and Karsh 2010). In general, the studies have found the basic proposition of TAM to be robust and today it is one of the most mature streams of research in IS (Venkatesh et al. 2003). In the context of healthcare, TAM has been employed to understand adoption of IT systems by medical personnel in health settings (e.g., Hu et al. 1999; Yarbrough and Smith 2007). A recent review by Holden and Karsh (2010) on the role of TAM in healthcare refers to it as the "gold standard" (p.159) and also calls for future research in health IT adoption to build on TAM by contextualizing it as TAM does not have the necessary contextual variables to account for a specialized domain as healthcare. In this research, the perceived usefulness of the HIT system represents the perceived benefit dimension of HBM and

is proposed to be influenced by the HBM constructs, perceived health threat and health motivation. The perceived ease of use of the HIT system is taken to represent the perceived barrier dimension of HBM and is proposed to be influenced by the HBM construct, health management self-efficacy.

Identifying Additional Constructs

Building on recent developments in technology adoption research, I present an overview of constructs that will be added to the TAM-HBM integrated model. This is done to incorporate relevant constructs that recent research has identified as important in a consumer IT adoption context (Venkatesh et al. 2012). The HBM model was developed to account for individual acceptance of preventive healthcare in a traditional non-technology setting. Hence, in studying consumer usage of health IT systems, there is a need to appropriately contextualize the HBM variables. To do this, I build on the relevant factors from UTAUT2 (Venkatesh et al. 2012) to account for the perceived benefits, barriers and cues to action dimensions of HBM.

UTAUT2

UTAUT2 is particularly relevant to the current context because it was developed to explain consumer adoption of technologies. It was proposed as an extension to the unified theory of acceptance and use of technology (UTAUT) (Venkatesh et al. 2003) to study consumer acceptance and usage of technologies. Further, it was validated in the context of *mobile internet users*, thus making it very relevant to the present mobile health applications context. Because it was developed specifically for the consumer context, it is of relevance to build on and identify relevant factors to better understand consumer acceptance of health technologies. UTAUT2 extended UTAUT to a consumer context by advancing three additional factors—hedonic motivation, price value, and habit—that complement the constructs proposed in UTAUT, namely

effort expectancy, performance expectancy, social influence and facilitating conditions (Venkatesh et al. 2012). By drawing on the UTAUT2 constructs – *hedonic motivation, facilitating conditions, price value and social influence* this research is able to account for the *perceived benefits, perceived barriers, and cues to action* dimensions of the HBM. In addition to the direct effects, UTAUT2 proposes that age and gender will moderate the relation between social influence, facilitating condition and price value with behavioral intention. Also, experience has been shown to moderate the relationship between facilitating condition and price value with behavioral intention.

In the present research, *price value, facilitating conditions and perceived ease of use (effort expectancy)* are used to represent the *perceived barrier, hedonic motivation and perceived usefulness (performance expectancy)* are used to represent the *perceived benefits*, and *social influence* is used to represent the *cues to action* dimension of the health belief model.

Facilitating Conditions

Facilitating conditions is defined as “the degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system” (Venkatesh et al. 2003, p. 453). In a consumer context, it has been defined as “consumer’s perceptions of the resources and support available to perform a behavior” (Brown and Venkatesh 2005; Venkatesh et al. 2012, p. 159). In a consumer health context facilitating conditions refers to the extent to which resources and assistance are available to support the use of mobile health application to manage health and wellness. Whereas UTAUT demonstrated that facilitating conditions would directly influence usage, UTAUT2 demonstrated that facilitating conditions in a consumer context (non-organizational context) can also influence the intention besides actual usage.

Social Influence

Social influence is the individual's perception that one's important others believe that he or she should engage in a certain behavior, such as using mobile health applications to manage a health condition. It has been defined as the "perceived pressure to perform the behavior in question" (Venkatesh and Brown 2001, p. 75) from one's network members. In a consumer health IT adoption context, social influence refers to the extent to which an individual perceives his or her family members, colleagues, friends or medical team believe they must use the HIT to manage health and wellness.

Price Value

Price value has been defined as "consumer's cognitive tradeoff between the perceived benefits of the applications and the monetary cost of using them" (Dodds et al. 1991; Venkatesh et al. 2012, p. 161). Because many mobile health applications involve an associated cost to acquire besides the cost involved in using smartphones, price value is a relevant construct.

Hedonic Motivation

Hedonic Motivation has been defined as the "fun or pleasure derived from using a technology" (Venkatesh et al. 2012, p. 161). While perceived usefulness (performance expectancy) can account for the extrinsic motivation to use the health app, enjoyment or hedonic motivation accounts for the intrinsic motivation to use the health app. With several health applications increasingly emphasizing on the "fun" aspect of using their app in staying fit through features such as, competing with other app users to shed weight, winning points and unlocking badges for progress made for reaching goals, hedonic motivation is a relevant factor to understand consumer adoption of health apps.

THEORY AND HYPOTHESIS DEVELOPMENT

Figure 1 presents the proposed research model. The rationale for the proposed relations and the hypothesis are presented in the following pages.

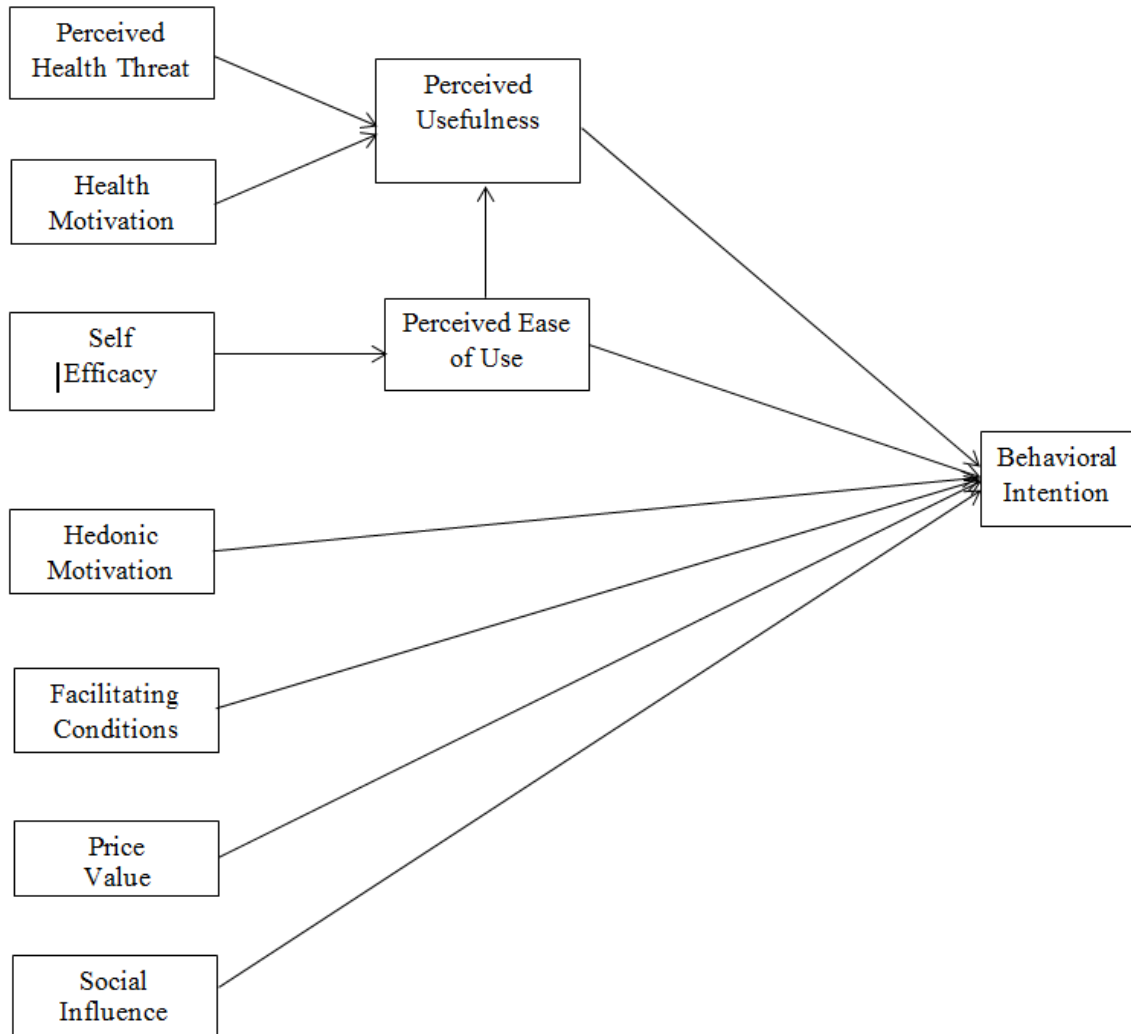


Figure1. Research Model

Perceived Health Threat

Perceived threat of ill health is associated with assessment of one's vulnerability to and severity associated with the health risk. Research in health sciences has found that when

individuals perceive a threat, they engage in measures to protect their health (e.g., Rosenstock 1974; Tanner et al. 1991). Also, research in IS on computer security behavior has shown that when individuals perceived their computers to be at threat of a security attack, their avoidance motivation was enhanced (Liang and Xue 2010) and in turn they engaged in protective behaviors. Thus, a perception of threat is likely to be associated with awareness of the need to engage in action to evade the threat. Anderson and Agarwal (2010) found that perceived threat was associated with positive attitude towards engaging in action to avoid the threat. When individuals perceive a health threat, they are likely to orient themselves toward actions that can help them avoid the threat. Therefore I argue that an individual's belief regarding the usefulness of IT systems that can enable them to cope with the threat will be high, as compared to someone with lower threat perception. For example, when an individual perceives a threat of heart attack due to obesity, he or she would consider monitoring their calorie intake as very important. Any tool that can empower the individual to monitor his or her calorie intake, such as a mobile health application like *MyFitnessPal*, would be considered as useful. Hence I hypothesize,

H1: Perceived threat of ill health will be positively associated with Perceived Usefulness of the health application

Health Motivation

An individual with a “pre-disposition” (Walker and Thomas 1982, p. 188) to engage in healthful behavior is likely to be conscious of his or her health and would be motivated to engage in healthful behaviors. When individuals have a positive disposition towards engaging in healthful behaviors, they are likely to engage in actions associated with health management as a way of avoiding cognitive dissonance between their attitudes and actions (Ajzen and Fishbein 1980). Prior research in marketing also shows that when individuals are conscious about their

health they are likely to engage in healthful behaviors (Jayanti and Burns 1998). Given their high motivation to watch their health, such individuals are likely to perceive tools that can aid in their self-health management activities as useful, as compared to someone whose motivation about self-health management is not as high. This is because the salience of utility of a health self-management aid is higher for them. For example, when one is highly health conscious he or she is likely to have favorable perceptions of tools that help individuals to monitor their general wellbeing, such as tools that can keep track their physical activity (RunKeeper), sleep pattern (SleepCycle) or calories consumed (MyFitnessPal) as compared to someone who is low on health orientation. Hence, I hypothesize:

H2: Health Motivation will be positively associated with Perceived Usefulness of the health application

Self-Efficacy

Self-efficacy refers to the individual's confidence in his or her ability to engage in healthful behavior (Rosenstock et al. 1988) and has been found to be an important predictor of healthful behavior (Abraham and Sheeran 2005). When individuals have the resources and knowledge necessary to engage in healthful behavior and are comfortable doing so, it is easier for them to manage their health on their own. For example, an individual who understands the role of dietary intake on health outcomes and is comfortable tracking their calorie intake through the day, is more likely to avoid consuming excess sodium or saturated fat compared to another individual who is not comfortable tracking dietary intake. Thus, when individuals confident in their ability to manage their health are presented with an aid, such as a health application to monitor calorie intake, they are more likely to feel comfortable using the app compared to someone who is not confident of self-managing one's health. In other words, the confidence in

performing the underlying health behavior can also influence the confidence in using the IT system to discharge the behavior. In the absence of prior experience with the health application, the *confidence in one's ability to use the health app* to manage health is likely to “serve as the basis for an individual's judgment about how easy or difficult a new system will be to use” (Venkatesh 2000, p. 347). Thus in the context of a new health application, the individual's overall confidence in one's ability to use health applications to manage his or her health will influence the ease of use perception. Between two individuals, the one with a greater confidence in his or her ability to use health application to manage their health is likely to think of the system as easier to use. Hence, I hypothesize:

H3: Self-efficacy will be positively associated with Perceived ease of use of the health application

Hedonic Motivation

As already noted hedonic motivation can account for the intrinsic motivation for using health apps. That is, apart from using the health app to gain health related benefits (performance outcomes), one could also use the app for the enjoyment that the health application affords “in it's own right” (Davis et al. 1992 p. 1113).

Health applications are essentially novel means of tracking health and wellness. For example, for someone who is intent on shedding body weight, tracking both dietary intake (calories consumed) and physical activity (calories lost) is important. This could be achieved by making a diary note of one's dietary consumption through the course of the day and also tracking the physical activities that one involves in. Tracking only one of the two activities (either physical activity or diet intake) could lead to sub-optimal results - excessive weight gain (when only physical activity is tracked and calorie consumed is not) or excess weight loss (when only

calorie consumed is tracked and physical activity is not). However, such manual tracking approaches are prone to error either due to *boredom* with having to make a note of all one's activities and dietary intake or due to *fatigue* associated with *micro-managing* one's health.

With a health application such as *MyFitnessPal*, one could simply scan the barcode of the food item and the associated calorie information along with detailed nutritional information (e.g., saturated fat, fiber, sodium) are logged. Also, several health applications also assist with easy tracking of physical activities by integrating with activity sensors such as *wristbands* offered by *Nike* and *Jawbone*. This lets one to track not only information such as total distance covered by walking or jogging and the associated calories lost but also finer aspects such as amount of time slept, the route through which one jogged among others. The captured information is automatically reconciled with one's dietary intake information which leads to an accurate picture of what one can eat or how much one has to work-out over the rest of the day to achieve one's health goals (e.g., weight loss goals). Besides, health applications also facilitate easy sharing of one's health activity details on social media – such as through, a Facebook update or a tweet on Twitter along with the route one covered during jogging or a list of all workouts one did at the gym. Other members can give *props* (congratulations) to convey appreciations for achievements or give *nudge* to motivate a member who has not been updating their physical activity details in a while to get active. Further, several health applications also have rankings such as a *Leaderboard* where the top weight losers or those that are most physically active are listed. Thus, the app also serves to enhance one's social standing and self-esteem. By giving *badges* and *tickers* for people to display on their profile page, health applications also allow people to signal their *health achievements* to others.

Thus health applications serve to make the monotonous and dreary task of health and wellness tracking in to one that is engaging (e.g., through a comprehensive picture of one's health information), informative (e.g., through detailed graphs and charts) and even fun (e.g., through social media updates and community access). Thus, it is very likely that the *hedonic* aspects of health application usage could very likely trigger an individual to consider using a health application. Although, with time (post-adoption) the hedonic motivation could "play a less important role in determining technology use" (Venkatesh et al. 2012, p.163), at the stage of initial adoption it is very likely to influence adoption decisions. Further, given prior support in the literature that shows that enjoyment can influence technology acceptance and use (e.g., Brown and Venkatesh 2005; Davis et al. 1992; van der Heijden 2004), I hypothesize:

H4: Hedonic Motivation will be positively associated with intention to adopt the health application

Facilitating Conditions

Prior research shows that an individual's perception of the available resource and support to engage in a behavior influences intentions (e.g., Ajzen and Driver 1992). A fundamental requirement to use technology artifacts, such as a mobile health application, is access to mobile devices that can support usage of applications, such as smart phones. Also, applications such as those that allow one to securely access one's provider's portal to access medical records need access to internet or a mobile data plan to function. In the case of complex applications, an individual might even require assistance to guide usage. Thus access to resources and support are important criteria that can influence individual's adoption intentions. Put differently, a lack of facilitating condition would be a barrier that could adversely impact the individual's likelihood of usage of such tools. Between two individuals, the one with greater access to resources and

support is more likely to adopt the health application compared to someone who does not have access to resources and support. Hence, I hypothesize:

H5: Facilitating conditions will be positively associated with intention to adopt the health application

Price Value

Price value refers to a “consumer’s cognitive tradeoff between the perceived benefits of the applications and the monetary cost of using them” (Dodds et al. 1991; Venkatesh et al. 2012, p. 161). Although some mobile applications are available for free download, because usage of most applications requires access to smart phones/devices and access to internet or network data plans, there is a cost associated with their usage. This is especially the case if smart phones and data plans are purchased mainly for using the health application. Also, if usage of the health application requires a lot of network bandwidth, the fee for using the bandwidth would entail an associated increase in one’s payment for the mobile service. Thus, it is only when the individual perceives the benefits of using a health application to be greater than the associated costs, that is, perceives there to be a price value, would one form intentions to adopt the application. Hence, I hypothesize:

H6: Price Value will be positively associated with intention to adopt the health application

Social Influence

In a health IT context, I expect one’s network (family members, friends, colleagues) to influence one’s health IT adoption decisions. This is because one’s health condition has implications for both, one’s household members as well as one’s friends and workplace colleagues. Hence, one’s network members and acquaintances are likely to impress upon the individual the need to take charge of one’s welfare through “messages and signals” (Venkatesh

and Brown 2001, p.75). An effective way to take charge of one's health management and recovery is by using external assistance through tools such as mobile health applications. Hence, it is likely that the focal individual will be subjected to external influences and hence the decision to adopt the health IT system will be characterized by a normative orientation (e.g., Burnkrant and Cousineau 1975). Thus, the influence from important others can serve as the "instigating event" which is often required to set the healthcare "process in motion" (Rosenstock 1966, p.101). Similarly, the opinion and advice of one's physician and caregivers is also likely to be significant in influencing the individual's behavioral intentions to adopt the health application. Hence, I hypothesize:

H7: Social Influence will be positively associated with intention to adopt the health application

Adoption Intention

The relation between technology related beliefs (perceived usefulness) and intentions to use the technology is a well-established relationship in IS literature (e.g., Bhattacharjee and Sanford 2006; Venkatesh 2000). Hence drawing on prior research that has established this robust relationship, I hypothesize:

H8: Perceived Usefulness will be positively associated with intention to adopt the health application

Similarly, the relation between perceived ease of use and perceived usefulness and perceived ease of use and intention is also well-established in prior research (e.g., Venkatesh 2000; Venkatesh and Davis 2000) and is expected to hold in the consumer IT context as well. Hence drawing on prior research that has established this robust relationship, I hypothesize:

H9: Perceived ease of use will be positively associated with perceived usefulness of the health application

H10: Perceived ease of use will be positively associated with intention to adopt the health application

METHODOLOGY

To test the proposed model, several efforts were made to survey patients at hospitals that provided health apps and customers of health app firms. However, due to privacy concerns associated with customer health data, most firms did not agree to the request. One health app firm that agreed to let me collect data was shut down even before the data collection could start due to poor *user adoption*. Following this, I opted for conducting a survey among members of an online consumer panel (Amazon Turk) to test the model using vignette of a health app. A vignette of a health application (Appendix B) was presented and the respondent's perceptions of the health app and intentions to adopt were elicited. The vignette was refined through consultation with doctoral students and an industry expert. An image and text based vignette was chosen over a video, as some respondents might be on slower internet connections or have bandwidth restrictions, which could potentially affect their response. The vignettes were further refined through the feedback from a pilot conducted among a sample of students (n=39). Subsequently, another pilot study was conducted among members of an online consumer panel (n=141). Analysis showed that the scales used in the survey had sufficient reliability. The actual survey was conducted among members of an online consumer panel. 391 usable responses were obtained. About 45 percent of the respondents were female. Table 3 shows the mean and standard deviation of the constructs in the research model.

Measurement

All of the scales used in this study were adapted from prior research. The scales for perceived usefulness and perceived ease of use were adapted from Davis (1989). Scales for price

value, facilitating conditions and social influence were adapted from Venkatesh et al. (2012). Scale for behavioral intention was drawn from Venkatesh (2000). Scale for perceived health threat was adapted from Liang and Xue (2010). Scale for health motivation was adapted from Gould (1988). Scale for self efficacy was adapted from Anderson and Agarwal (2010). Experts in health sciences were consulted to ensure that the measures used for health constructs were appropriate.

RESULTS

I used partial least squares (PLS) to test the proposed model (Smart-PLS software version 2.0.M3). PLS was chosen over LISREL/AMOS as the aim of this study is theory development and not theory testing (Komiak and Benbasat 2006), and PLS is better suited for exploratory research (Gefen et al. 2000). I first examined the measurement model before proceeding to test the structural model.

Measurement Model

As seen from Table 2 the reliabilities of all the scales were greater than .7 and thus the scales used were reliable (Hair et al. 2009). Also, the pattern of loadings show that all items loaded more highly on their substantive construct than on other constructs, satisfying the convergent validity criteria. The average variance extracted (AVE) was greater than .5 (Hair et al. 2009) and also the squareroot of the AVE (Table 3) was greater than the inter-construct correlations, satisfying the discriminant validity criteria (Fornell and Larcker 1981). Thus, the model has adequate psychometric properties.

Table 2. PLS Loadings and Cross-Loadings

Construct (Composite reliability)		1	2	3	4	5	6	7	8	9	10
Behavioral Intention (.99)	BI1	0.99	0.22	0.73	0.28	0.12	0.25	0.41	0.58	0.10	0.57
	BI2	0.99	0.24	0.72	0.29	0.13	0.25	0.42	0.58	0.11	0.56
Perceived Ease of Use (.96)	PE1	0.17	0.91	0.25	0.58	0.34	0.26	0.22	0.10	0.11	0.56
	PE2	0.24	0.91	0.33	0.51	0.33	0.33	0.23	0.14	0.13	0.56
	PE3	0.19	0.94	0.31	0.55	0.42	0.33	0.25	0.13	0.14	0.57
	PE4	0.25	0.94	0.35	0.56	0.43	0.36	0.29	0.16	0.18	0.55
Perceived Usefulness (.97)	PU1	0.71	0.32	0.94	0.32	0.18	0.30	0.49	0.56	0.19	0.25
	PU2	0.70	0.36	0.95	0.34	0.16	0.30	0.49	0.55	0.16	0.31
	PU3	0.68	0.30	0.95	0.29	0.15	0.26	0.48	0.55	0.14	0.24
	PU4	0.68	0.31	0.96	0.27	0.14	0.28	0.50	0.58	0.13	0.31
Facilitating Conditions (.89)	FC1	0.23	0.42	0.23	0.89	0.31	0.20	0.23	0.13	0.07	0.17
	FC2	0.21	0.72	0.25	0.77	0.36	0.27	0.26	0.10	0.16	0.20
	FC3	0.29	0.43	0.33	0.90	0.30	0.27	0.22	0.24	0.13	0.23
Self-Efficacy (.94)	SE1	0.13	0.31	0.15	0.29	0.82	0.27	0.13	0.10	0.03	0.16
	SE2	0.13	0.42	0.19	0.35	0.92	0.32	0.15	0.09	-0.01	0.22
	SE3	0.11	0.39	0.15	0.38	0.92	0.36	0.15	0.07	0.01	0.18
	SE4	0.09	0.30	0.13	0.29	0.82	0.26	0.10	0.10	-0.05	0.16
	SE5	0.08	0.34	0.09	0.28	0.83	0.34	0.10	0.06	0.00	0.13
Health Motivation (.90)	HM1	0.27	0.28	0.34	0.25	0.15	0.87	0.25	0.26	0.27	0.27
	HM2	0.22	0.34	0.23	0.29	0.46	0.88	0.14	0.17	0.18	0.26
	HM3	0.17	0.36	0.19	0.26	0.50	0.77	0.15	0.09	0.14	0.18
	HM4	0.15	0.19	0.19	0.13	0.17	0.79	0.11	0.16	0.21	0.24
Price Value (.97)	PV1	0.34	0.26	0.41	0.25	0.12	0.18	0.94	0.30	0.12	0.30
	PV2	0.43	0.27	0.53	0.28	0.16	0.22	0.98	0.38	0.13	0.38
	PV3	0.43	0.25	0.53	0.25	0.14	0.21	0.97	0.38	0.11	0.36
Social Influence (.98)	SI1	0.58	0.14	0.56	0.18	0.10	0.22	0.35	0.97	0.09	0.49
	SI2	0.55	0.14	0.57	0.20	0.07	0.20	0.36	0.96	0.08	0.50
	SI3	0.57	0.15	0.58	0.18	0.10	0.22	0.36	0.97	0.09	0.50
Health Threat (.91)	TH1	0.08	0.10	0.13	0.09	-0.07	0.17	0.05	0.05	0.86	0.09
	TH2	0.06	0.12	0.13	0.15	-0.02	0.20	0.04	0.04	0.86	0.08
	TH3	0.10	0.16	0.12	0.10	0.05	0.20	0.14	0.04	0.75	0.07
	TH4	0.11	0.14	0.18	0.12	0.02	0.26	0.17	0.14	0.90	0.12
Hedonic Motivation (.96)	HM1	0.52	0.55	0.29	0.23	0.20	0.30	0.33	0.47	0.09	0.96
	HM2	0.60	0.61	0.35	0.26	0.21	0.32	0.40	0.51	0.13	0.94
	HM3	0.47	0.50	0.18	0.17	0.15	0.19	0.28	0.47	0.09	0.92

Note: One of the facilitating condition items (FC4) was dropped as it had poor loading (.53) on the substantive construct. Dropping the item increased the reliability of the scale from .85 to .89

Table 3. Correlations and AVEs

		1	2	3	4	5	6	7	8	9	10
1	HEDM	0.94									
2	THRT	0.11	0.84								
3	HMOT	0.30	0.25	0.83							
4	SE	0.20	-0.01	0.36	0.86						
5	PEOU	0.30	0.15	0.35	0.41	0.93					
6	PU	0.59	0.17	0.30	0.17	0.34	0.95				
7	FACD	0.24	0.14	0.29	0.37	0.59	0.32	0.85			
8	PV	0.36	0.13	0.21	0.15	0.27	0.52	0.27	0.96		
9	SINF	0.51	0.09	0.22	0.09	0.15	0.59	0.19	0.37	0.97	
10	BI	0.57	0.11	0.25	0.13	0.23	0.73	0.29	0.42	0.59	0.99

Note:

1. HEDM – Hedonic Motivation THRT – Health Threat HMOT – Health Motivation SE – Self Efficacy PEOU – Perceived Ease of Use PU – Perceived Usefulness FACD – Facilitating Condition PV – Price Value SINF – Social Influence BI – Behavioral Intention
2. Diagonal elements represent squareroot of average variance extracted (AVE)

Table 4. Descriptive Statistics

		Mean	S.D.
1	HEDM	4.43	1.44
2	THRT	5.39	.86
3	HMOT	5.33	1.18
4	SE	5.65	1.05
5	PEOU	6.07	0.91
6	PU	5.49	1.35
7	FACD	5.8	1.01
8	PV	5.94	1.22
9	SINF	4.13	1.66
10	BI	4.86	1.88

Note:

1. HEDM – Hedonic Motivation THRT – Health Threat HMOT – Health Motivation SE – Self Efficacy PEOU – Perceived Ease of Use PU – Perceived Usefulness FACD – Facilitating Condition PV – Price Value SINF – Social Influence BI – Behavioral Intention

Structural Model

To test for common method bias, in the lines of Venkatesh et al. (2012), I used Liang et al.'s (2007) approach of specifying a method factor in PLS and Malhotra et al.'s (2006) approach for post hoc estimation of CMV. The results of these tests (Appendix D) show that CMV is less of a concern in this study.

In testing the structural model, I controlled for *age, gender, race, education, income, health information seeking behavior, media influence, insurance influence, physician influence, computer self-efficacy, privacy concerns, hedonic motivation* and *overall health status*.

Hypothesis 1 predicted that health threat would influence perceptions of usefulness of the health app. As the results in Figure 2 indicate, this relationship was not significant (path = .078, $t = 1.49$, $p > .05$). Thus, Hypothesis 1 is not supported. Hypothesis 2 predicted that health motivation would influence perceptions of usefulness of the health app. The results indicate that health motivation was positively related to perceived usefulness and the relationship was significant (path = .191, $t = 4.02$, $p < .001$). Thus, Hypothesis 2 is supported. Hypothesis 3 predicted that self-efficacy would influence perceptions of ease of use of the health app. The results indicate that self-efficacy was positively related to perceived ease of use and the relationship was significant (path = .41, $t = 7.75$, $p < .001$). Thus, Hypothesis 3 is supported. Hypothesis 4 predicted that hedonic motivation would influence behavioral intention to adopt the health app. The results indicate that hedonic motivation was positively related to behavioral intention and the relationship was significant (path = .143, $t = 3.2$, $p < .001$). Thus, Hypothesis 4 is supported. Hypothesis 5 predicted that facilitating conditions would influence behavioral intention to adopt the health app. The results indicate that facilitating conditions was positively related to behavioral intention and the relationship was significant (path = .099, $t = 2.24$, $p <$

.05). Thus, Hypothesis 5 is supported. Hypothesis 6 predicted that price value would influence behavioral intention to adopt the app. The results indicate that the relationship was not significant (path = .024, $t = 0.60$, $p > .05$). Thus, Hypothesis 6 is not supported. Hypothesis 7 predicted that social influence would influence behavioral intention to adopt the app. The results indicate that social influence was positively related to behavioral intention and the relationship was significant (path = .135, $t = 2.66$, $p < .01$). Thus, Hypothesis 7 is supported. Hypothesis 8 predicted that perceived usefulness would influence behavioral intention to adopt the app. The results indicate that perceived usefulness was positively related to behavioral intention and the relationship was significant (path = .472, $t = 8.39$, $p < .001$). Thus, Hypothesis 8 is supported. Hypothesis 9 predicted that perceived ease of use would influence perceptions of usefulness of the app. The results indicate that perceived ease of use was positively related to perceived usefulness and the relationship was significant (path = .26, $t = 4.41$, $p < .001$). Thus, Hypothesis 9 is supported. Hypothesis 10 predicted that perceived ease of use would influence behavioral intention to adopt the app. The results indicate that this hypothesis was not supported (path = -.073, $t = 1.72$, $p < .05$). The research model could explain 62 percent of variation in behavioral intention to adopt the health app. Table 4 lists the path coefficients along with the t-statistic. The results of the hypothesis test are summarized in Table 5.

Table 5. Path coefficients and t-statistic

Path	Path coefficient	t-statistic	p-value (one-tailed)
THRT → PU	.078	1.49	n.s. (.068)
MOT → PU	.191	4.02	<.001
SE → PEOU	.414	7.75	<.001
PEOU → PU	.260	4.41	<.001
PU → BI	.472	8.39	<.001
PEOU → BI	-.073	1.72	<.05 (.04)
FACD → BI	.099	2.24	<.05(.01)
PV → BI	.024	.60	n.s. (.27)
SINF → BI	.135	2.66	<.01 (.004)

Note:

THRT – Health Threat MOT – Health Motivation SE –Self Efficacy PEOU – Perceived Ease of Use PU – Perceived Usefulness FACD – Facilitating Condition PV – Price Value SINF – Social Influence BI – Behavioral Intention HIS – Health Information Seeking behavior CSE – Computer Self-Efficacy

DISCUSSION

Recently, scholars had given a call for research to study issues surrounding consumer adoption of health IT systems (Agarwal et al. 2010). This research is a response to this call in the literature and it focused on the factors that drive consumer adoption of health applications (health apps). Given that research on user adoption of technology is “one of the most mature streams of information systems research” (Benbasat and Barki 2007; Venkatesh et al. 2007; Venkatesh et al. 2012 p. 157), the objective for this study was to extend this stream of research to a consumer health IT context. This was accomplished by using the health belief model (Rosenstock 1974) as the framework and drawing on recent research on consumer adoption of IT (Venkatesh et al. 2012) and TAM to identify relevant constructs for the consumer health IT context. The model could explain 62 percent of the variance in intention to adopt the health app.

The study found that *perceived usefulness, hedonic motivation, facilitating conditions* and *social influence* are important drivers of consumer’s health app adoption intention. The findings are consistent with the finding in the larger context of user adoption of technology (e.g.,

Venkatesh et al. 2003) and consumer adoption of technology (e.g., Venkatesh et al. 2012). Also, *self-efficacy* of managing health was found to influence perceptions of ease of use of the health app. Interestingly, the study found that *health motivation* and not *health threat* to be an important driver of perceived usefulness. This suggests that attempts to influence health motivation (such as through positive messages) may be more effective than attempts to heighten perceptions of health threat (such as through negative messages) in driving health app adoption. This is interesting because, there is a stream of research that examines how fear appeals could be used to induce desired healthful behavior such as smoking cessation (see for example, Kees et al. 2010). The present research suggests that consumer health IT context could be a boundary condition for the efficacy of compliance gaining strategies based on fear-inducement.

As with all research, the present research also has some limitations. First, the study was conducted using a vignette of a health app. Thus participants had limited opportunity to understand the application better by exploring the various features. Future research is required to understand the extent to which the findings generalize when the respondents get to directly interact with the app, as in a real world setting. Second, while this research informs us as to what the major factors that drive consumer adoption of health apps are, it does not throw any light on specific design features that might in turn inform app development. Third, this research did not manipulate any of the variables as all the participants received the same treatment. For example, ease of use had a mean score of 6.07 indicating that there was not much variance in the way the study participants perceived the ease of use of the app, which could have possibly influenced the observed PEOU-BI relationship. Future research employing an experimental design wherein participants are assigned to varying ease of use conditions can address this shortcoming to validate the findings of this study. Finally, this research considered only adoption intentions and

thus does not inform us about the factors that drive sustained usage over time. Future research could consider usage post-adoption to further enrich our understanding of the underlying factors that drive consumer adoption and usage of health apps.

Theoretical Contributions and Implications

This research makes several key contributions to the literature. By integrating two well established theory streams, i.e., HBM and TAM, this research advances our knowledge of factors that drive consumer adoption of health IT. Also, by integrating the HBM with TAM using theory-driven arguments, this research accounts for the intervening mechanism through which the health belief variables affect one's healthful behavior. Seen another way, this research proposes health related antecedents to the TAM constructs. In so doing, this research also addresses the call in the literature to better understand the issues around user acceptance of HIT systems (Agarwal et al. 2010). By adapting the UTAUT2 constructs to a consumer health IT setting, this research is also one of the first IS research studies to integrate UTAUT2 with the HBM and also UTAUT2 with the TAM. In doing so, this research also has extended the application of UTAUT2 to a consumer health context from a consumer IT context. Finally, this is one of the first IS research studies to identify the factors underlying consumer adoption of HIT systems, specifically health apps. Thus it advances our current state of knowledge of user adoption of IT to a healthcare context.

Practical Implications

The findings of this study have implications for software firms, hospitals and government agencies engaged in the development of health and wellness apps. A key question that faces developers of health apps is, *how to get consumers to try my health app from among the thousands of similar apps available*. This is because the first step to engaging the customer and

sustaining them over period is actually to make the customer try the product/service in the first place. This research presents various implications that are valuable to practitioners. First, the research findings suggest that interventions that seek to enhance one's health motivation – such as those that highlight the benefits of staying healthy or tracking calorie intake using the app are more likely to be effective in influencing perceptions of usefulness of the health app. Thus, while using graphic images on cigarette pack may be an effective way of dissuading consumers from smoking (Kees et al. 2010), in the context of health apps it appears, such fear-inducing strategies may not be as effective. This means, health app advertisements could be tuned to being more promotion-focused. Given the significant amount of money that firms are spending on online advertisements, knowledge of what kind of message in the advertisement is likely to yield the desired outcome is valuable to drive health app adoption.

Second, this research shows that social influence is an important predictor of adoption intentions. So, health app firms could attempt to leverage social networks, such as Facebook, Twitter to induce social contagion (Aral and Walker 2011) of app adoption across the network. For example, early adopters of the app liking the app on their Facebook page or tweeting about the benefits of using the app could serve to more strongly appeal to the attention of the members in the focal member's social circle. Finally, although this research found a negative relationship between perceived ease of use and behavioral intention, practitioners may want to exercise caution in using this finding to decide their app design strategy. While challenges in the course of an healthful behavior (such as competing with a friend to shed body weight) is likely to be beneficial, the usage of the health app itself being challenging (not easy to use) is likely to undermine adoption of health apps. Similarly, the fact that price value did not have a significant influence seems to suggest that cost may not be a barrier in health app adoption. However, health

app firms may want to approach this finding with caution before scaling up their app prices based on this study. Given the fact health app adoption is sluggish even when health apps are largely free, more research is needed to ascertain whether increasing price may not necessarily derail adoption intentions.

CONCLUSION

Drawing on extant research on user and consumer adoption of IT systems and the health belief model, this research identified the factors that underlie consumer adoption of health apps. Considering the widespread availability of mobile devices among consumers, they are an excellent channel to build on to influence healthful behaviors. Thus, there are lot of opportunities for researchers to advance our knowledge of issues associated with consumer adoption and usage of mobile health artifacts and the downstream health and economic consequences. Findings from such research will not only assist the thousands of health app developers but also lend support to the government's focus on empowering and involving consumers in their health management.

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APPENDIX A MEASUREMENT ITEMS

Perceived Health Threat (Adapted from Liang and Xue (2010))

To measure Perceived Health Threat, the respondent was first asked:

Which of the following health issues are you the most concerned about?

- Heart disease
- Diabetes
- Asthma
- Obesity
- Cancer
- High blood pressure/hypertension
- Back problems/surgery
- High cholesterol
- Depression
- Known genetic disorder (any type)
- Other (Please specify) _____

In the following questions "Health Issues" refers to the *complications and issues* associated with <<*name of the health issue from above*>>.

For example, Obesity related Health issues could be getting diabetic and as a consequence ==> getting a heart disease, going blind, being an amputee, or even dying

For the following questions, please consider the "*complications and issues*" associated with <<*name of the health issue from above*>>

1. Health issues pose a threat to me
2. The trouble caused by health issues threatens me
3. It is dreadful if I have health issues
4. Health issues are a danger to my life

Health Motivation (Adapted from Gould (1988))

1. I reflect about my health a lot
2. I'm very involved with my health
3. I'm usually aware of my health
4. I'm very self-conscious about my health

Self-Efficacy (Adapted from Anderson and Agarwal (2010))

1. Managing my health is entirely under my control

2. I feel comfortable managing my health
3. I am confident in my ability to manage my health
4. Taking the necessary measures to manage my health is easy
5. I have the resources and knowledge to manage my health

Perceived Usefulness (Adapted from Davis (1989))

1. I find the PocketHealth app useful in managing my health
2. Using the PocketHealth app would enhance my effectiveness in managing my health
3. Using the PocketHealth app would help me accomplish my health management goals
4. Using the PocketHealth app would improve my performance in my health management

Perceived Ease of Use (Adapted from Davis (1989))

1. Learning how to use the PocketHealth app would be easy for me
2. I expect the PocketHealth app to be easy to use
3. It would be easy for me to become skillful at using the PocketHealth app
4. My interaction with the PocketHealth app is likely to be clear and understandable

Facilitating conditions (Adapted from Venkatesh et al. (2012))

1. I have the resources necessary to use the PocketHealth app.
2. I have the knowledge necessary to use the PocketHealth app.
3. The PocketHealth app would be compatible with other technologies I use.
4. I can get help from others when I have difficulties using the app. (dropped)

Price Value (Adapted from Venkatesh et al. (2012))

All things considered

1. The PocketHealth app is reasonably priced
2. The PocketHealth app is a good value for the money.
3. At the current price, the PocketHealth app provides a good value.

Social Influence (Adapted from Venkatesh et al. (2012))

1. People who are important to me would think that I should use the PocketHealth app
2. People who influence my behavior would think that I should use the PocketHealth app
3. People whose opinions that I value would prefer that I use the PocketHealth app.

Behavioral Intention (Adapted from Venkatesh (2000))

1. Assuming I had access to the PocketHealth app, I intend to use it
2. Given that I had access to the PocketHealth app, I predict that I would use it

Hedonic Motivation (Adapted from Venkatesh et al. (2012))

1. Using the PocketHealth app will be fun.
2. Using the PocketHealth app will be enjoyable.
3. Using the PocketHealth app will be very entertaining.

APPENDIX B HEALTH APP VIGNETTE



The PocketHealth™ app is a mobile personal health record designed for individuals or families who want to personally control and manage their health and wellness.

Image source: <http://mobihealthnews.com/22773/mobile-phr-startup-cognovent-shuts-down-blames-delay-in-mu2/>



The app will enable you to keep important information such as healthcare records and immunization records for yourself and for members of your family that you might be caring for – all in one place (right in your mobile device).

Image source: <http://www.iphoneappsfinder.com/free-apps/pockethealth-for-iphone/>

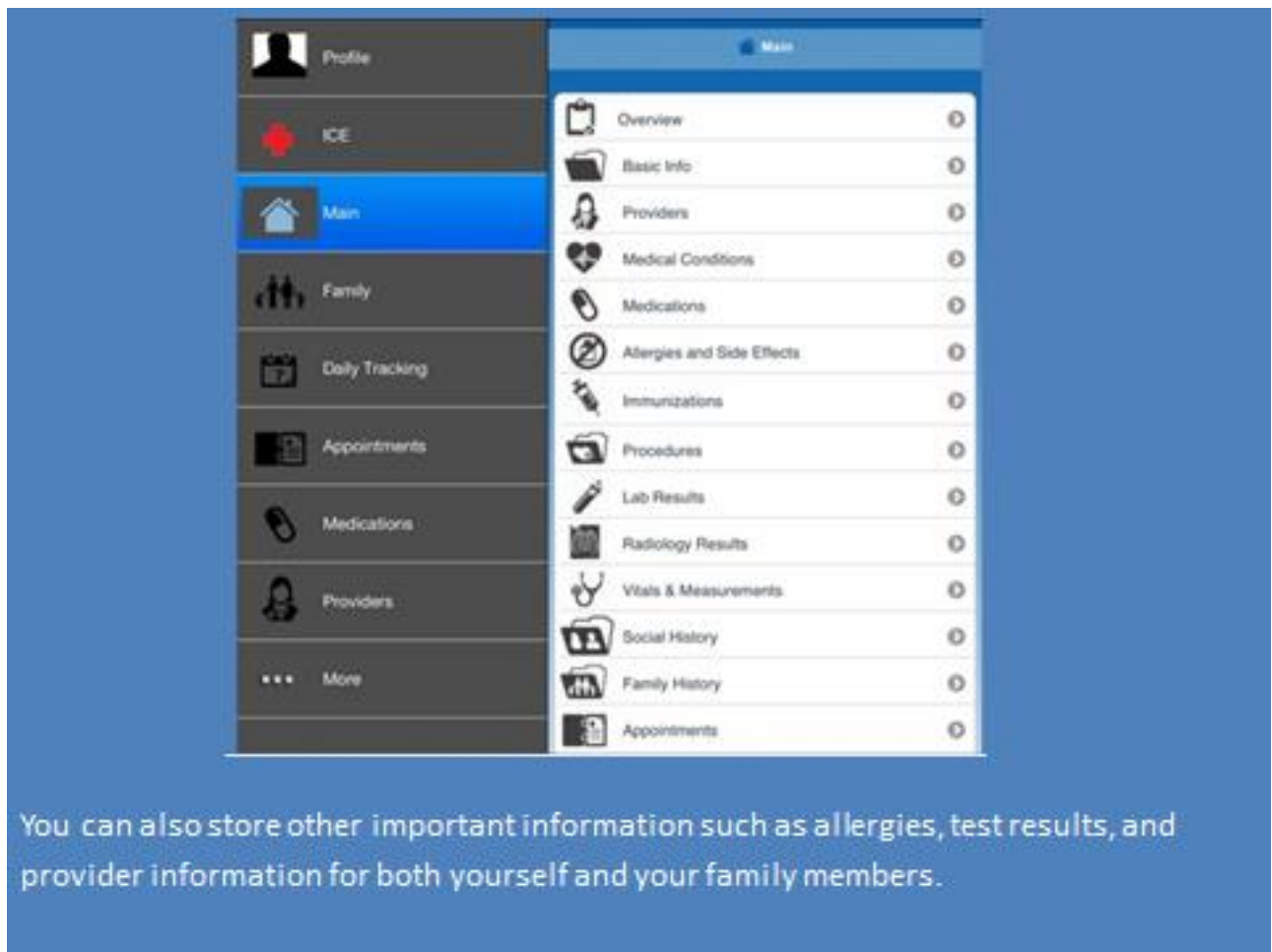
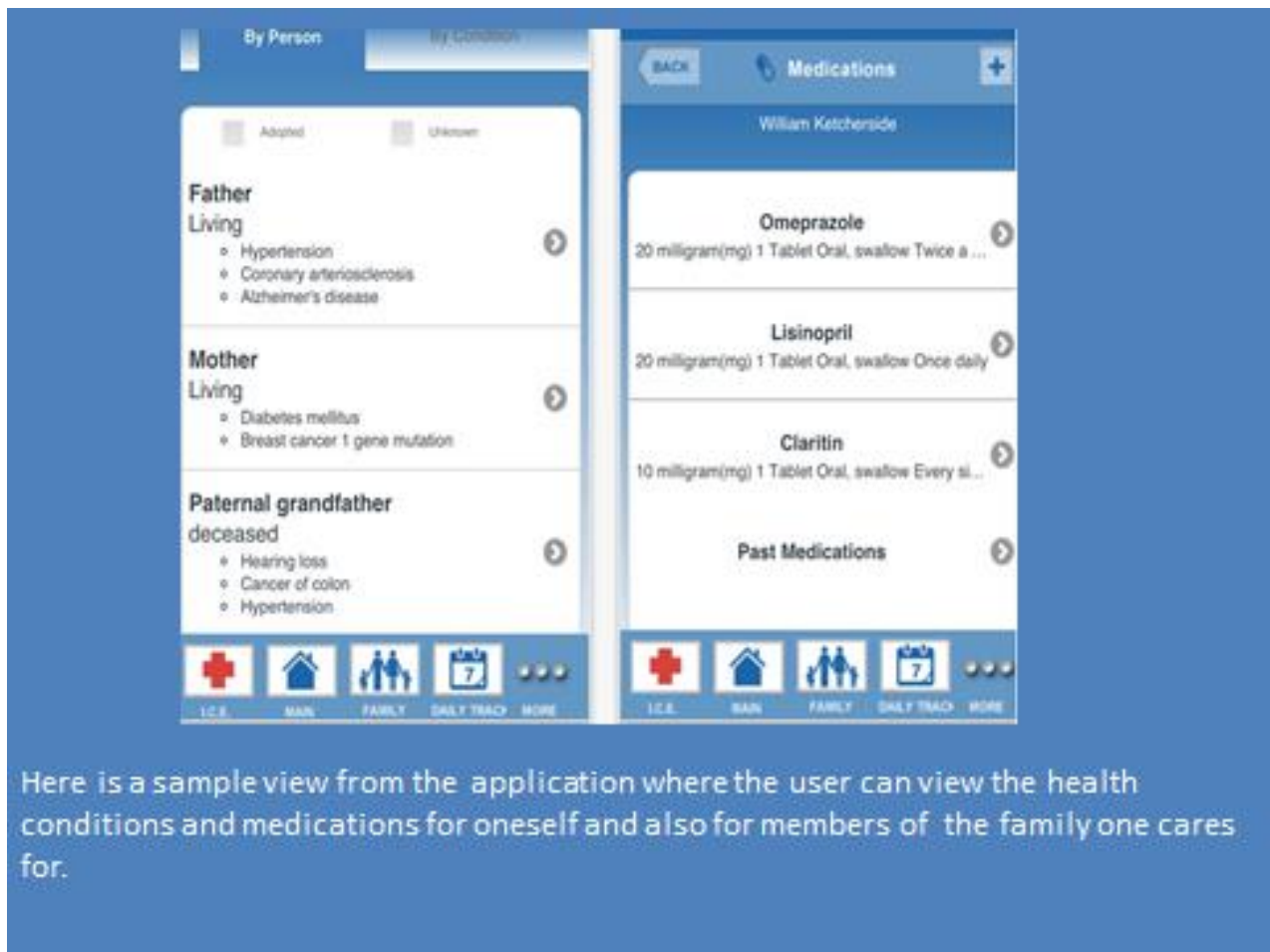


Image source: <http://www.imedicalapps.com/2012/06/personal-health-record-patient-medical-terms/>



Here is a sample view from the application where the user can view the health conditions and medications for oneself and also for members of the family one cares for.

Image source: <http://www.iphoneappsfinder.com/free-apps/pockethealth-for-iphone/>

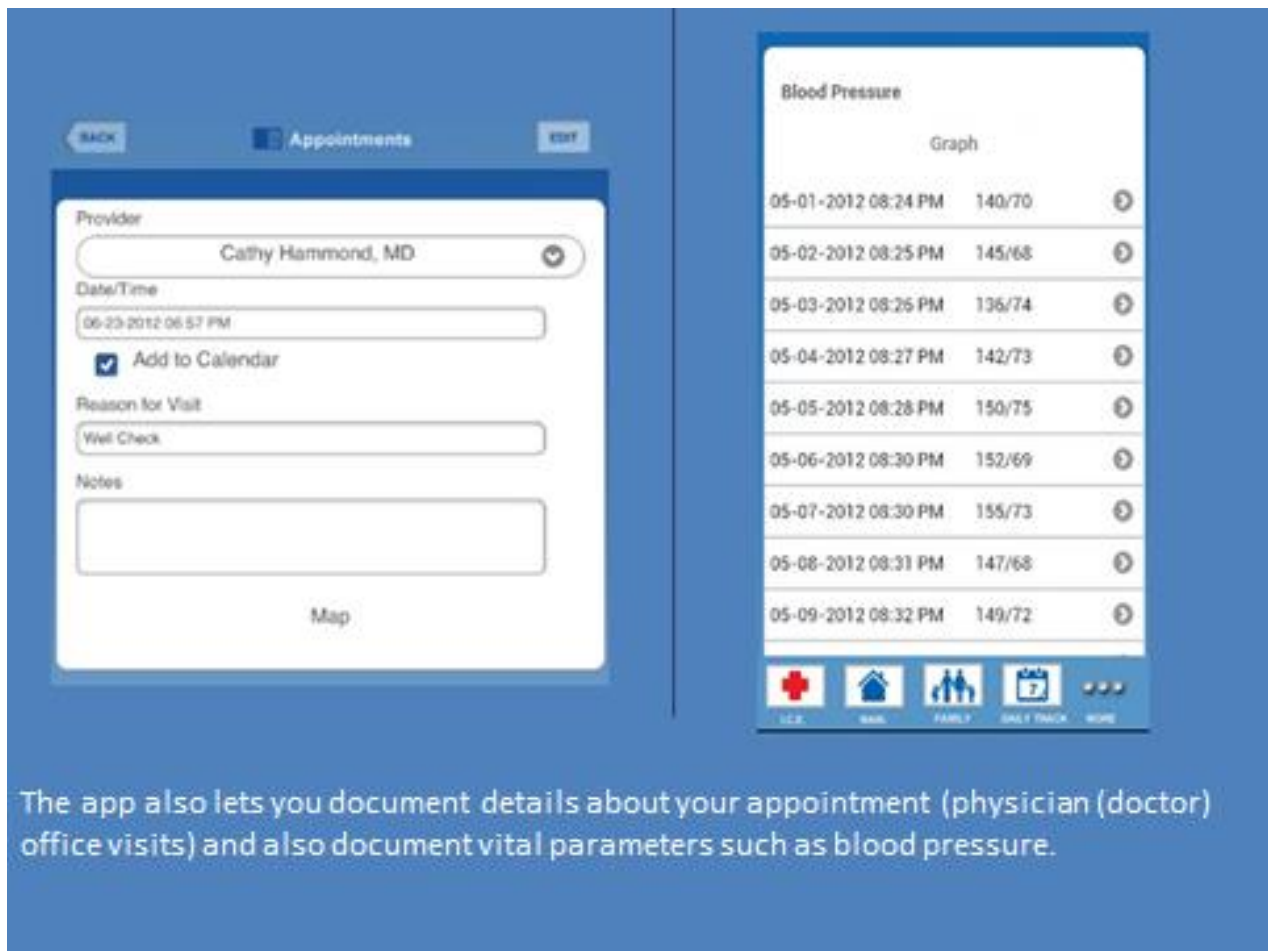


Image source: Adapted from <http://www.imedicalapps.com/2012/06/personal-health-record-patient-medical-terms/pocket-health-2/>



All too often health history information isn't quickly and easily shared with patients and/or with and by their physicians in urgent situations. The "in-case of emergency" feature helps the user to easily seek help and assistance.

PocketHealth app allows you to share the information you deem necessary with healthcare providers—without waiting for hours or even days for medical records to be accessed and delivered.

Image Source: <http://www.imedicalapps.com/2012/06/personal-health-record-patient-medical-terms/pocket-health-5/>

**My Information**

- Name: John A Doe
- Date of Birth: 1955-7-6
- Blood Type: A Pos
- Gender: Male
- Height:
- Weight:

Emergency Contact

- Name: Jane Doe
- Relationship: Wife
- Phone Number: [502 123-4567](tel:5021234567)
- Mobile Number: [\(502\) 987-6543](tel:5029876543)
- Email: janedoe@bellsouth.net

Allergies & Side Effects**Active Medications**

- dehydroepiandrosterone

Medical Conditions

- Osteoarthritis

Primary Physician

- Cathy Hammond, MD

Health Insurance

- Carrier: Humana
- Group Number: 123456
- ID Number: 1265768945 01

Image source: <http://www.imedicalapps.com/2012/06/personal-health-record-patient-medical-terms/pocket-health-6/>



Your Information, Your Device

All the health information you input to the app is stored "in your mobile device". Your health information is NOT stored in a central repository anywhere outside your device. Also, the data is encrypted and so even if you lose your phone, the data is secure.

So you have full control over the health information stored in the app !

Image Source: <http://www.datacenterjournal.com/it/what-to-do-if-you-have-a-security-breach-in-your-data-center/#!prettyPhoto>



The app is available for use on

- iPhone, iPad and Android devices

The basic features are available for “FREE”.

Features that let you add Procedures, Lab results, Radiology results and track blood glucose daily with graphing are available for \$ 0.99

To manage all the above information for the entire family the cost of upgrade is \$ 3.99

Image Source: <http://www.siliconprairienews.com/2012/05/cognovant-raises-500k-nears-release-of-first-product-pockethealth>

APPENDIX C TABLE OF PATH COEFFICIENTS

Path	Path coefficient	t-statistic	p-value (one-tailed)
THRT → PU	.078	1.49	n.s. (.068)
MOT→PU	.191	4.02	<.001
SE→PEOU	.414	7.75	<.001
PEOU→PU	.260	4.41	<.001
PU→BI	.472	8.39	<.001
PEOU→BI	-.073	1.72	<.05 (.04)
FACD→BI	.099	2.24	<.05(.01)
PV→BI	.024	.60	n.s. (.27)
SINF→BI	.135	2.66	<.01 (.004)
HMOT→ BI	.143	3.2	<.001
<i>Control variables</i>			
Age	.013	.33	n.s.
Gender	.016	.46	n.s.
Income	.033	1.04	n.s.
Race	.051	1.42	n.s.
Education	.045	1.34	n.s.
HIS	.003	.09	n.s.
Overall Health	.033	1.01	n.s.
Media Influence	-.032	.90 (.895)	n.s.
Privacy Concern	-.086	2.42	<.01
Insurance Influence	-.007	.16	n.s.
Physician Influence	.143	2.97	<.01
CSE	-.006	.16	n.s.

THRT – Health Threat MOT – Health Motivation SE –Self Efficacy PEOU – Perceived Ease of Use PU – Perceived Usefulness HMOT – Hedonic Motivation FACD – Facilitating Condition PV – Price Value SINF – Social Influence BI – Behavioral Intention HIS – Health Information Seeking behavior CSE – Computer Self-Efficacy

APPENDIX D COMMON METHOD BIAS ANALYSIS

Following Venkatesh et al. (2012), I used the method recommended by Malhotra et al. (2006) and Liang et al. (2007) to test for common method variance. First, I used Liang et al.'s (2007) unmeasured latent variable technique to assess common method bias. The average variance explained by the method factor was under .01 and that explained by the substantive factor was around .82 (See Table D1).

Second, using Malhotra et al.'s (2006) approach I identified the second smallest positive correlation (.02) and deducted this value from all correlations. When the analysis was conducted again no major difference was observed between the original and adjusted correlation estimates.

Thus, overall, CMV appears to be less of a concern in this study.

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Table D1. Average Variance Explained by Substantive and Method Factor

	Items	Substantive factor (R1)	R1-Squared	Method factor (R2)	R2-Squared
Self-Efficacy	SE1	0.847	0.717	-0.031	0.001
	SE2	0.818	0.669	0.006	0.000
	SE3	0.895	0.801	0.041	0.002
	SE4	0.852	0.726	-0.035	0.001
	SE5	0.910	0.828	0.013	0.000
Health Motivation	HM1	0.860	0.740	-0.108	0.012
	HM2	0.781	0.610	0.072	0.005
	HM3	0.801	0.642	0.013	0.000
	HM4	0.885	0.783	0.018	0.000
Threat	TH1	0.737	0.543	0.032	0.001
	TH2	0.881	0.776	-0.031	0.001
	TH3	0.864	0.746	0.054	0.003
	TH4	0.890	0.792	-0.051	0.003
Perceived Ease of Use	PE1	0.973	0.947	-0.084	0.007
	PE2	0.898	0.806	0.013	0.000
	PE3	0.950	0.903	-0.013	0.000
	PE4	0.884	0.781	0.081	0.007
Perceived Usefulness	PU1	0.903	0.815	0.048	0.002
	PU2	0.912	0.832	0.043	0.002
	PU3	0.987	0.974	-0.045	0.002
	PU4	0.994	0.988	0.045	0.002
Facilitating Condition	FC1	0.966	0.933	-0.114	0.013
	FC2	0.721	0.520	0.112	0.013
	FC3	0.867	0.752	0.017	0.000
Price Value	PV1	0.993	0.986	-0.075	0.006
	PV2	0.950	0.903	0.044	0.002
	PV3	0.947	0.897	0.028	0.001
Behavioral Intention	BI1	0.986	0.972	0.005	0.000
	BI2	0.994	0.988	-0.005	0.000
Social Influence	SI1	0.970	0.941	-0.003	0.000
	SI2	0.965	0.931	-0.006	0.000
	SI3	0.962	0.925	0.010	0.000
Hedonic Motivation	HM1	0.972	0.945	-0.016	0.000
	HM2	0.834	0.696	0.144	0.021
	HM3	1.017	1.034	-0.133	0.018

Variance explained by R1-Squared=.82; R2-Squared=.004

APPENDIX E RESEARCH COMPLIANCE PROTOCOL LETTER

MEMORANDUM

TO: S. Sankara Subramanian
Fred Davis

FROM: Ro Windwalker
IRB Coordinator

RE: New Protocol Approval

IRB Protocol #: 13-06-761

Protocol Title: *A Survey of Health App Users*

Review Type: EXEMPT EXPEDITED FULL IRB

Approved Project Period: Start Date: 06/28/2013 Expiration Date: 06/27/2014

Your protocol has been approved by the IRB. Protocols are approved for a maximum period of one year. If you wish to continue the project past the approved project period (see above), you must submit a request, using the form *Continuing Review for IRB Approved Projects*, prior to the expiration date. This form is available from the IRB Coordinator or on the Research Compliance website (<http://vpred.uark.edu/210.php>). As a courtesy, you will be sent a reminder two months in advance of that date. However, failure to receive a reminder does not negate your obligation to make the request in sufficient time for review and approval. Federal regulations prohibit retroactive approval of continuation. Failure to receive approval to continue the project prior to the expiration date will result in Termination of the protocol approval. The IRB Coordinator can give you guidance on submission times.

This protocol has been approved for 1,500 participants. If you wish to make *any* modifications in the approved protocol, including enrolling more than this number, you must seek approval *prior to* implementing those changes. All modifications should be requested in writing (email is acceptable) and must provide sufficient detail to assess the impact of the change.

If you have questions or need any assistance from the IRB, please contact me at 210 Administration Building, 5-2208, or irb@uark.edu.

APPENDIX F PERMISSION FROM TRADEMARK HOLDER

From: W Joseph Ketcherside [mailto:joeketch@me.com]
Sent: Friday, November 22, 2013 8:36 AM
To: Sankara Subramanian Srinivasan
Subject: Re: Update on the survey

Hi Sakar, yes I do recall well. You do have my permission to use the name and screenshots for your research and all publications which follow from it. Best of luck!

Nice write-up, glad we could help you.

Joe

W Joseph Ketcherside MD

Chief Executive Officer

Ketcherside Group, LLC

Health Informatics/Corporate Strategy

M (816) 922-9176

F (866) 579-1616

joeketch@me.com

On Nov 22, 2013, at 1:35 AM, Sankara Subramanian Srinivasan <ssriniva@uark.edu> wrote:

Dear Dr. Ketcherside,

Hope you recall me contacting you earlier regarding my study of health apps.

After running the vignettes I had prepared about PocketHealth through you, I used it in my survey as part of my dissertation research (attached).

I am presently mailing you to request a written permission from you that I could include in my dissertation draft for using the name of the PocketHealth app and screenshots of the app.

Please let me know if you need any other details.

Thank you very much for your help

Sincerely

Sankar

ESSAY 2: THE ROLE OF INTERVENTIONS IN DRIVING

CONSUMER ADOPTION OF HEALTH APPS

ABSTRACT

Consumer adoption of Health IT (HIT) systems continues to lag despite significant improvement in accessibility and affordability of these systems. Recent research has shown that framing of arguments in favor of the HIT system (highlighting the benefits) could be a way to drive user adoption intentions. A growing body of literature suggests that consumers attach a lot of importance to user reviews (i.e., word of mouth information) and that it can significantly impact user attitudes, intentions and even actual behavior. Against this backdrop, this research examined the interplay between firm-generated message (to promote health app adoption) and word of mouth message on user adoption intentions of health applications. The findings suggest that message framing strategies that emphasize the benefits of using the app could be an effective way to influence consumer perceptions of usefulness of the health app and in turn adoption intentions. In particular, the results show that when the user reviews agree with (are congruent with) the app firm's claims, the resultant congruence enhances perceptions of trust and usefulness. *Post hoc* analysis shows that the effect of congruence on perceived usefulness is *partially mediated* by trust. Further, perceived usefulness *fully mediates* the effect of trust on adoption intentions. Implications for research and practice are discussed.

INTRODUCTION

“Privacy concerns related to EHR use can be alleviated through proper messaging”²

The above statement is from the *recent news* page of the website of Center for Health Information and Decision Systems (CHIDS) at the University of Maryland from the year 2006. This is a significant finding and can mean a great deal for the nation’s thrust on promoting digitization of health information. It essentially says that appropriate framing of messages could be a powerful tool, and by extension suggests that, through appropriately tailored messages it is possible (for agencies such as hospitals, government and developers of HIT applications) to drive user adoption of HIT systems such as electronic health records. This is critical because there are numerous new players entering the consumer health IT market in response to the government’s call to empower and engage the consumers in their wellness management. In particular, with the growing emphasis on prevention and wellness, there is a lot of attention being paid to developing applications for mobile devices that can help track and manage health and wellness activities. Several hospitals, government agencies, software firms and independent developers are involved in the development of mobile health applications and there are thousands of mobile health applications with more than 13,000 applications in Apple’s app store alone (Consumer Health News 2012). Considering the number of players involved in this mobile health application market, the key differentiator of a firm is how clearly it conveys its message (value proposition) to potential customers. Thus, health app developers need guidelines on how to promote their products to have favorable user response, such as downloading and installing the health app. Of particular interest in this context is the failure of Google’s consumer focused health IT offering GoogleHealth. The failure of Google despite owning the largest advertisement channel in the

² Source: <http://www.rhsmith.umd.edu/chids/connect/>

world draws attention to other factors that could possibly influence consumer behavior. In the backdrop of consumers today having access to various sources of information besides the firm generated message (advertisement), an important question that faces providers of mobile health applications is *what is the effect of the opinion of the public (word of mouth information) on the efficacy of the promotion of my service?*

Research on consumer health IT systems is fairly nascent in IS literature. Research to date has largely focused on privacy issues associated with health information digitization and sharing. For example, research has examined issues such as how one's health status affects intentions to transact with health websites (Bansal and Davenport 2011), efficacy of privacy assurance mechanisms in disclosing health information (Bansal et al. 2008), adoption of electronic health records (EHR) to store health information (Angst and Agarwal 2009) and willingness to share health information (Anderson and Agarwal 2011). In particular, recent research by Angst and Agarwal (2009) examined whether individuals could be persuaded to let their health records be digitized through persuasive messages that highlight the benefits associated with digitizing health records. They found that messages framed *positively* (highlighting the benefits) could positively influence individual's attitude toward HIT systems (EHR) even in the presence of privacy concerns. This research shows that a positive message frame could be a powerful way to influence consumer attitudes and could potentially influence adoption intentions. While this finding has significant implications for driving consumer adoption of HIT systems, we do not yet know if such message framing strategies are effective even in the presence of *competing information sources*, which a consumer has access to, in influencing HIT adoption intentions. This is because an individual's opinions and beliefs are shaped by varied sources of information, and increasingly social media plays a prominent role in

shaping the opinions and beliefs. In recent years, there has been a proliferation of such electronic word of mouth (WOM) information (Gu et al. 2012) on account of the growing use of social media like Facebook and Twitter. A growing body of research examining the consumer usage of WOM information (Mudambi and Schuff 2010; Pavlou and Gefen 2004) has shown that such information can affect consumer's purchase decisions (Dellarocas 2003) and even actual sales (Chen 2008; Chevalier and Mayzlin 2006). Also, a recent survey by Pew internet research shows that more than 70 percent of U.S. adult respondents had referred online for health information (Pew 2011). This suggests that people are willing to trust online sources of information even for highly sensitive matters such as one's health. Thus, it is likely that online sources of information would be referred to while deciding purchase of health management tools, such as mobile health applications also. Against this backdrop, it is of interest to know what effect the message (from the HIT vendor) has on an individual's intention to adopt HIT systems (mobile health applications) in the presence of WOM information. This is of theoretical relevance for the following reasons. Extant research shows that both message framing (e.g., Angst and Agarwal 2009) and WOM information (e.g., Chen 2008; Chevalier and Mayzlin 2006) can influence consumer beliefs, intentions and behavior. However, it is not clear as to what is the effect of the interplay of these two factors on intentions and behavior to adopt HIT systems in general, and mobile health applications in particular. Considering that thousands of mobile health applications are available in the market and that enormous amounts of time and effort are spent in their development, it is of interest to better understand the role of this interplay between the two sources of information about the HIT on adoption intentions. Knowledge of this interplay between mainstream information cues and WOM information on consumer has largely remained in need of further research.

In this research I integrate findings from three different research streams by using the processing fluency and trust theories as the lens. First, IS research has demonstrated that, arguments presented to an individual can shape both beliefs (Bhattacharjee and Sanford 2006) and attitudes about a system (Angst and Agarwal 2009). Second, research in advertising has shown that congruence of message in advertisement and website can affect trust by affecting the fluency of processing (de Vries and van Rompay 2009). Finally, IS research on the role of trust in e-commerce has shown that trust can affect both perceived usefulness (e.g., Gefen et al. 2003; Gefen and Straub 2002; Pavlou 2003) and intentions (e.g., Awad and Ragowsky 2008; Komiak and Benbasat 2006; Pavlou and Gefen 2005). By integrating the findings from these research streams, I argue that the degree of congruence between the message presented by the focal firm (message framing) and the message one perceives from user generated content (WOM), would influence the trust and the processing fluency of the information. Subsequently, the trust and the system related beliefs (perceived usefulness) would affect the adoption intentions.

This research is of significance in that, firms are leveraging the capability afforded by internet in getting their message to the masses through electronic advertisement channels such as contextual advertising, search engine marketing, banner advertising, email marketing and spending a lot of money. In doing so, this research underscores the need to be vigilant of another message source that could be outside the firm's control, which could potentially impact customer attitudes and intentions. Particularly, in the HIT domain where the government is engaged in unprecedented efforts to empower customers and engage them in their health management through IT, there is a need to also be aware of what the consequences of public opinion are on individual HIT adoption decisions. Such knowledge will not only help design appropriate

interventions to drive HIT adoption among consumers but also, engage in appropriate interventions to influence public opinion.

This research contributes to IS research in several ways. First, it integrates the message framing and word of mouth literature streams, which despite their similarity have continued to be studies in silos. Second, to the best of my knowledge, IS research to date has not focused on the processing fluency theory, which the marketing literature shows to be having powerful influences over consumer attitudes and behavior (e.g., Winkielman and Cacioppo 2001). By integrating the processing fluency theory in to the IS literature, this research advances our understanding about how messages are processed and what the consequences of such processing are on downstream consequences such as adoption. Third, by focusing on word of mouth related to healthcare, it also fills the gap in the WOM literature involving high involvement products (Gu et al. 2012). The bulk of the research on WOM has dealt with book sales (Forman et al. 2008; Hu et al. 2008; Li and Hitt 2008), CD sales (Hu et al. 2008), movie sales (Dellarocas et al. 2007; Duan et al. 2008), and beer sales (Clemons et al. 2006) and thus there is a gap in our knowledge relating to WOM on high involvement products (Gu et al. 2012). Given that health is of significance to everyone, I would classify health apps as a high involvement product. Thus, by focusing on WOM related to health apps, this research contributes to this growing body of research as well. Finally, given that there is limited research on the role of interventions in driving adoption and usage (Venkatesh and Bala 2008), this research contributes to the body of research on interventions driving IT adoption and usage also by studying the boundary conditions for the efficacy of arguments presented.

In the following sections, I present the theoretical background, research model, the hypothesis that follows from it, the proposed study design and the expected contributions.

THEORETICAL BACKGROUND

In this section, I present the relevant literature and theoretical background as it relates to this conceptual model.

Message Framing

Message framing refers to construction of messages either as positively worded or negatively worded to influence a desired outcome, such as attitudinal change or behavioral compliance. It has been used by researchers in health sciences (e.g., Janke et al. 2011), marketing (e.g., Block and Keller 1995; Kees et al. 2010; Maheswaran and Meyers-Levy 1990), social psychology (e.g., Brewer and Kramer 1986; Meyerowitz and Chaiken 1987) and recently IS (Anderson and Agarwal 2010; Angst and Agarwal 2009). In the context of healthcare, research that employ message framing strategies have studied how presentation of information positively or negatively can influence health behaviors, such as sunscreen usage (Detweiler et al. 1999), dental flossing (Mann et al. 2004), self-management of chronic pain (Janke et al. 2011), breast self-examination (Meyerowitz and Chaiken 1987) among others. This stream of research draws on prospect theory (Tversky and Kahneman 1981) which was proposed to explain why behavior may not be guided only by rational choice. It suggests that the manner in which a message is presented can influence decision making (choices) even when the message fundamentally presents the same information (Tversky and Kahneman 1984). Specifically, the theory suggests that responses to loss-framed message (emphasizing negative outcomes) are likely to be stronger than response to gain-framed messages (emphasizing positive outcomes). However, research findings on the efficacy of loss-framed messages have “yielded variation in findings” (Anderson and Agarwal 2010 p.631). Further, research also suggests that negatively framed messages could

lead to defensive processing of the message (e.g., Liberman and Chaiken 1992) through responses such as message avoidance and *seizing and freezing* (Block and Williams 2002).

Drawing on extant research on prospect theory, Rothman and colleagues synthesized and adapted the findings to a healthcare context in the form of taxonomy (Rothman and Salovey 1997; Rothman et al. 2003) to explain when gain-framed and loss-framed messages are likely to be effective in influencing healthful behavior. The taxonomy is based on the observation that “the function served by a health behavior can be a reliable heuristic” (Rothman et al. 2006 S205) to explain whether individuals perceive a behavior as risky. They propose that when individuals are faced with a health behavior, such as engaging in mammography, that has the inherent risk of an *unpleasant outcome* (detection of cancer), a negatively framed (loss framed) message would be persuasive compared to a positively framed (gain framed) appeal. Similarly, they also propose that when individuals are faced with prevention behavior, that can help avoid incidence of health issues, a positively framed (gain framed) message would be more persuasive compared to a negatively framed (loss framed) appeal.

Only recently, researchers in IS have begun to consider the effect of the message presented to users on attitude and behavior (Anderson and Agarwal 2010; Bhattacharjee and Sanford 2006; Angst and Agarwal 2009). Anderson and Agarwal (2010) studied how framing of messages as promotion-focused (gain frame) and prevention-focused (loss frame) could in turn influence the “proximal drivers of intentions to perform security-related behaviors” (p.638). They found that *gain-framed marketing messages* are likely to be most effective in influencing the consumer to engage in behaviors to secure one’s computer. In the context of consumer willingness to allow their health information to be digitized in Electronic Health Records (EHR), Angst and Agarwal (2009) found *positively framed messages* to be useful in driving EHR

adoption intentions. Thus, this research suggests that gain framed messages may be effective in driving health IT adoption.

Building and extending on this research finding in the context of EHR adoption, the focus of the present research is to examine the efficacy of *gain framed (positively framed) messages* in driving adoption of health apps. Importantly, this research examines the role of external information sources such as user reviews (Online Word of Mouth information) on the efficacy of message framing strategies.

Online Word of Mouth (WOM)

Online WOM refers to the reviews of a product or a service by consumers on online platforms (Hennig-Thurau et al. 2004). Unlike traditional word of mouth communication, online WOM is characterized by high levels of scalability (in reach) and in speed of diffusion (Cheung and Thadani 2010). WOM communications happen over forums, bulletin boards, blogs, and increasingly in social networking sites. WOM sources such as Online reviews are not only a critical source of aggregated information about a product or service (Wang and Benbasat 2007), but are also an important piece of information in conveying the “overall marketing story” (Church and Iyer 2011, p.1; Ghose and Han 2009; Mudambi and Schuff 2010) and can help increase customer conversion rates (Barton 2006). Prior research has examined the effect of WOM at the market and individual levels of analysis (Christy and Cheung 2010; Lee and Lee 2009). At the individual level, which is of interest in the present research, WOM has been seen as a source of influence on the receiver by influencing attitude and decisions (Cheng et al. 2009; Park and Kim 2008; Park and Lee 2009). Thus, WOM is an important channel of persuasion that a customer is subjected to. In this research, I particularly focus on the message content of the

WOM (user review) and the message content of the focal firm's advertisement (message framing) and the effect of the interplay between the two on consumer's HIT adoption intentions.

Congruence

Congruence can be defined as the *fit* (e.g., Aaker and Keller 1990), *similarity* (e.g., Boush et al. 1987), "*match*" or "*agreement*" (Edwards 1994) between two entities. It is the extent to which "two or more objects, entities, people or groups share essential characteristics" (Kulkarni et al. 2008). For example, congruence could be the degree of fit between the image of a newly launched product and the image of the parent brand (e.g., Aaker and Keller 1990). Prior research on congruence has examined the effect of congruence between endorser and the endorsed product on the effectiveness of endorsement (Biswas et al. 2013, Till and Busler 2000), congruence in values between team member and superior on job satisfaction (Edwards and Cable 2009; Jung and Avolio 2000; Meglino et al. 1989), need for congruency with one's mood on preferences in aesthetic experiences (Lee et al. 2013) among others. In the context of technology adoption (e-book readers) Anton et al. (2013) found that congruence between individual's perception of devices and their self-image influenced both attitude and adoption intentions positively. Other researchers view fit as relevance (e.g., McDonald 1991). In general, congruence is considered as positive in terms of its consequences (Fleck and Quester 2007) and it can also facilitate "consumer's processing of the message" (p. 977).

Specifically, in the context of health related message framing (advertising), Kees et al. (2010) found that fit between goal pursuit strategy in the advertisement and consumer's regulatory focus to enhance the effectiveness of the advertisement. This finding is also in line with the findings of Mann et al. (2004) which showed that health messages were likely to be effective when the message matched the dispositional motivation (approach/avoidance

orientation) of the individual. Further, in their research on examining the influence of congruence in messages in advertisement and on the company's website, de Vries and van Rompay (2009) showed that the congruence can affect trust both directly as well as by affecting the fluency of processing experienced. In the context of current research, congruence is defined as the extent to which the *message content* in word of mouth information fits (agrees with) the *message content* in the health app's claims (advertisement). Thus, when there is a high level of congruence between the two message sources, drawing from de Vries and van Rompay (2009), we would expect the trust to be influenced as a result of the fluency of processing experienced.

Processing Fluency

Processing fluency refers to the experience associated with processing a piece of information (Cho and Schwarz 2006). The easier the processing of the information the higher is the associated processing fluency. Prior research has found processing fluency to have a positive impact on affect (Winkielman and Cacioppo 2001), judgment (e.g., Lee and Labroo 2005; Winkielman et al. 2003), evaluation (e.g., Janiszewski and Meyvis 2001) and choice confidence (Tsai and McGill 2011). In particular the processing fluency enhances liking for the target (e.g., Winkielman et al. 2003). The positive affect associated with the experience of processing fluency is supposed to influence even trusting intentions (Hansen et al. 2008; Reber and Schwarz 1999). The determinants of processing fluency include *clarity, symmetry, order, and simplicity* (Reber et al. 2004).

In the current context, the degree of congruence between the message presented by the HIT vendor and the WOM information can create fluency in processing on account of the *symmetry in messages*. However, lower the congruence in the messages, the dissonance (Festinger 1957) will reduce the fluency of processing. In the context of current research,

processing fluency literature suggests that symmetry in message can influence ease of processing and this fluency experienced can impact trusting intentions. That is, when there is a symmetry (or congruence) in the message content of the argument framing (from the vendor) and the word of mouth information, the associated fluency in processing will influence affect in terms of a favorable perception of the app – as *useful* and as *trustworthy*.

Trust

Trust is conceptualized as a rational choice (Coleman 1990; Hardin 2002) made by the trustor about the trustee and it is supposed to develop when reasons to trust have been found (Lewis and Weigert 1985). It is the belief that the other party will act in a dependable, ethical and socially appropriate manner (Gefen et al. 2003). Trusting belief has been most used in IS research indicating a predominantly cognitive orientation towards trust in the literature (Komiak and Benbasat 2006). Trust is pertinent in online environments because of the uncertainties involved in transacting with an e-vendor (McKnight et al. 2002) and the “absence of proven guarantees” about the vendor’s behavior (Gefen et al. 2003, p.55). In an e-commerce context, trust has been defined to be based on the “beliefs in the trustworthiness of a trustee” (Gefen et al. 2008, p. 276) and has shown to be an important predictor of both perceived usefulness (e.g., Gefen et al. 2003; Gefen and Straub 2002; Pavlou 2003) and intentions (e.g., Awad and Ragowsky 2008; Komiak and Benbasat 2006; Pavlou and Gefen 2005).

Trustworthiness belief is theorized to be composed of the dimensions – integrity, benevolence and ability (Gefen 2002; McKnight et al. 2002). Adapting to a HIT context, trust in integrity is the belief that the HIT vendor *will deliver* its service as promised; trust in benevolence is the belief that the HIT vendor has the customer’s interest in mind; and trust in ability is the belief that the HIT system *is capable* of delivering the service it promised. The

integrity aspect of trust is relevant to the current context because, the word of mouth information is essential a basis to verify the credibility of the claims made by the vendor. Thus when the user reviews (or user experiences) agree with the claims in the advertisement, it suggests that the vendor is someone who keeps up their promise and one that is reliable. Hence, I focus on the integrity aspect of trust in this research.

THEORY AND HYPOTHESIS DEVELOPMENT

In this section, I present the research model and the rationale for of the hypothesis. Figure.1 shows the proposed research model. As discussed earlier, the research model synthesizes prior work dealing with - the role of influence process in IT acceptance (Bhattacharjee and Sanford 2006), word of mouth (e.g., Chen 2008; Chevalier and Mayzlin 2006), role of message congruence and the resulting processing fluency on trust (de Vries and van Rompay 2009), and role of trust in e-commerce (Gefen et al. 2008). By integrating the findings from these research streams, I argue that the *degree of congruence* between the message presented by the focal firm (message framing) and the message one perceives from word of mouth information would influence trust and perceived usefulness of the HIT system. This is due to the underlying fluency experienced in processing the messages. As a result, trust and the system related beliefs (perceived usefulness) would affect the adoption intentions.

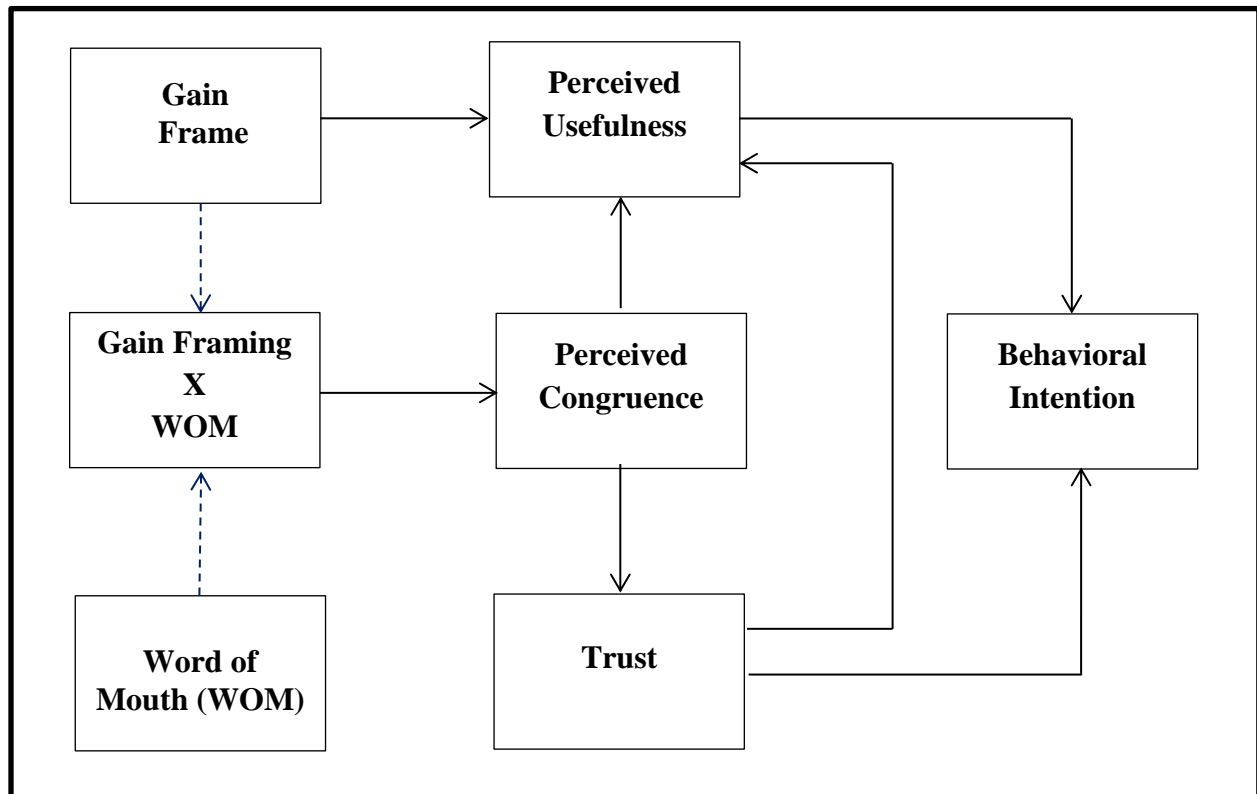


Figure1. Research Model

Gain Frame

Health apps are essentially prevention-oriented tools used to guide people to adhere to exercise routine, dietary plans, medication advice among others to ensure health and wellness. Drawing on the taxonomy of Rothman and Salovey (1997), we would expect that gain-framed messages would be most effective to drive health app adoption as they “elicit greater interest in and use of prevention behaviors” (Rothman et al. 2006 p. 206). For example, health researchers found gain-framed messages to be most effective to drive self-management of chronic pain (Janke et al. 2011) and motivate sunscreen usage among beachgoers (Detweiler et al. 1999). Further, recent IS research in the context of EHR adoption also suggests that consumer willingness to let their health information be digitized in EHRs can be influenced through

positively framed messages (Angst and Agarwal 2009). When positive message frame is employed to promote a health app, the message conveys the benefits that can accrue by using the health app. For example, when message states:

“By *keeping* your body weight under control you *decrease your risk* of contracting chronic diseases (e.g., *hypertension, diabetes, heart disease*). You will save money on unnecessary hospital visits, co-pays and by not having to miss workdays. This means, a *higher quality of life*, overall! The first step to *enjoying all the benefits* of *staying fit* is to be in control of your diet intake, physical activity and ensuring adequate rest. Our *WeightKeeper*TM app can assist you with this!”

the user perceives the benefits of using the app. Thus the user is likely to form positive perceptions of the utility of the application. Further, research in message persuasion suggests that when strong arguments are presented, the message conveyed by the argument is compelling and persuasive (Petty et al. 1981). When strong and credible arguments also highlight the potential positive outcomes associated with usage of the health application, individuals are more likely to be persuaded and form positive perceptions of the utility of the application (Sussman and Siegel 2003). Further, IS research shows that quality of the arguments presented can influence the perceptions of usefulness of IT system (Bhattacharjee and Sanford 2006). Hence, I hypothesize:

H1: Gain Frame will be positively associated with perceived usefulness of the health application

Perceived Congruence

As noted earlier, congruence is defined as the extent to which the message content in the firm’s advertisement fits (agrees with) with the message content in the word of mouth information (e.g., online user reviews). When the advertisement (message frame) highlights the benefits associated with the use of the health application and the word of mouth information

(user reviews) also attests to the benefits through positive evaluations, the consumer perceives a fit in what the message from the firm claimed and what the actual user experiences were. For example, when the app firm claims,

our app can help you stay fit and be in control of your diet intake and physical activity

and the user review echoes the firm's claim through reviews such as

This app has helped me gain control over my fitness

I feel more in control of my health and diet intake

the firm's claim and the user's experience seems to be in *sync*. Thus, the perceptions of congruence between the two message sources will be high. When the argument framing is positive, and the word of mouth information has a negative evaluation (e.g., *This app has not helped in any way to gain control over my health*), the consumer perceives a lack of fit between the firm's claim and actual user experience. Because the arguments from the firm highlight the benefits under positive (gain) framing, the perceptions of congruence will be lower in this case as compared to a case where the user reviews are positive. This is because of the dissonance (Festinger 1957) between the messages sources. Hence, I hypothesize:

H2: WOM information will interact with gain frame to positively impact perceived congruence such that the relationship is stronger for positive WOM

The word of mouth information (WOM) is not only an additional piece of information to base one's decision on, but is also a way to assess the vendor's claim. When a customer finds that the claims of a vendor about a product are *aligned* with the experiences of people who have used the product, it endorses the vendor's claims. Thus, it provides the customer a basis to assess how true the focal vendor is (integrity) in making claims about one's product. So, when the perceived congruence is high (a case where message framing is positive, and the word of mouth

information also has a positive evaluation), it will influence the trusting beliefs positively. This is also consistent with the findings of de Vries and van Rompay (2009) who found that high congruence between advertisement and website content to influence trust.

Further on account of the congruency between the two messages, the individual will find it easier to process the message, as prior research shows that *symmetry*, *order*, and *simplicity* (Reber et al. 2004) will be associated with fluency in processing. For example, consider a mobile health application provider claiming that their service would automatically update the user's physical activity data from their mobile application to their personal health record 99.9 percent of the times. However, if customer reviews show that the application behaves erratically and the user has to often manually enter their health related data, there is a certain degree of dissonance (Festinger 1957) in the messages. In this case, the processing of messages is more effortful as the individual has to reconcile the difference in the messages, as compared to a case where there is a greater degree of agreement between the firm's (message's) claims and prior customer's experiences. Because ease of processing is known to be associated with positive affect and trusting intentions (Hansen et al. 2008; Reber and Schwarz 1999), I expect that congruence in message would also influence the positive perceptions of the app – in terms of greater perceived usefulness and trust. Hence, I hypothesize:

H3: Perceived congruence will be positively associated with trust

H4: Perceived congruence will be positively associated with perceived usefulness

Trust and Perceived Usefulness

Trust has been found to be an important predictor of perceived usefulness by prior research (e.g., Gefen et al. 2003; Gefen and Straub 2002; Pavlou 2003). Because uncertainty is high in an e-commerce context, “part of the guarantee” (Pavlou 2003 p.78) that one can get the

expected benefits from the product or service is dependent on the seller (Gefen 2001). As Pavlou argues, when a seller is not considered as reliable there is “no reason why consumers should expect to gain any utility” (Pavlou 2003 p.78) from using the seller’s product. While this is true in the context of e-commerce products in general, this is all the more likely in the case of a healthcare product such as a health app because there are few things as consequential to an individual as one’s health (Anderson and Agarwal 2011). Thus, when one trusts the health app, one is more likely to consider that one will get the health benefits by using the health app compared to when one does not trust. In other words, with increasing levels of trust, perceptions of usefulness of the health app are also likely to increase. Hence I hypothesize:

H5: Trust will be positively associated with perceived usefulness of the health app

Perceived Usefulness and Intention

The relation between perceived usefulness and behavioral intention is well-established in prior literature (e.g., Venkatesh 2000; Venkatesh and Davis 2000). Also, in the context of driving IT adoption through arguments, Bhattacharjee and Sanford (2006) found that, perceived usefulness resulting from the quality of the argument presented could influence IT usage intention. Hence, I hypothesize:

H6: Perceived usefulness will be positively associated with intentions to adopt the health application

Adoption Intention

Trust has also been shown to be an important predictor of behavioral intentions in e-commerce context by prior research (e.g., Awad and Ragowsky 2008; Gefen et al. 2003; Komiak and Benbasat 2006; Pavlou 2003; Pavlou and Gefen 2005). When an individual trusts a health app seller they are also likely to have “stronger feelings of security and comfort” (Komiak and

Benbasat 2006 p. 946) in relying on their app for managing one's health. This is because, unless the health app seller is reliable, one could "suffer a loss" (Pavlou 2003, p. 79) or "detrimental consequences" (Gefen et al. 2003, p. 62) in terms of poor health outcomes or may not get the desired health benefits. Thus, it is likely that between two apps that an individual considers for adoption, the app that one considers as more reliable (trustworthy) is likely to be adopted. Trust in particular is likely to play a key role in health app context because, considering the thousands of health apps in every category – diet apps, sleep apps, exercise apps – the extent to which one perceives a health app seller as reliable is likely to serve as a reliable heuristic to minimize the complexity of decision making (e.g., Luhman 1979). Hence I hypothesize:

H7: Trust will be positively associated with intentions to adopt the health application

METHODOLOGY

To test the proposed model, I adapted the experimental approach employed by Angst and Agarwal (2009). In their research, Angst and Agarwal manipulated message framing by designing *positive* and *neutral* arguments. Since, neutrally framed arguments are not commonly employed by firms in marketing their products, to ensure semblance with actual practices employed in the field, I build on prior research in marketing and health sciences that employed message framing (e.g., Mann et al. 2004) and designed positive (gain) and negative (loss) message frames. Further, since the focus of this research is to specifically examine the role of word-of-mouth information on the efficacy of message frames, I also created positive and negative word-of-mouth information (user reviews) by adapting actual reviews of health apps. Following this, a pilot study was conducted to ensure that the vignettes thus created were perceived appropriately (manipulation check).

Design of Vignettes

I designed the message frames by drawing on advertisements of health apps available in the market and by referring to similar message frames used in research studies in marketing and health sciences. The messages were designed such that *only the emphasis* of the message varied across the two treatments while the structure of the message remained the same (see Appendix B). The framed messages were further refined in consultation with a subject matter expert from the Marketing discipline. I designed positive and negative word of mouth information by drawing on actual user reviews of health applications available online, such as on Apple's appstore.

Pilot Study-Manipulation check

To ensure the validity of the vignettes thus created and to refine the survey, I conducted pilot studies among members of an online consumer panel (Amazon Turk). The first pilot study (n=87) was focused on ensuring that the message frame and word of mouth manipulations worked as intended. Manipulation check (t-test) results show that the manipulations were effective for message frame ($M_{\text{GAIN}} - 4.83$, $M_{\text{LOSS}} - 3.53$, $p < .001$) and also for word of mouth ($M_{\text{PWOM}} - 6.47$, $M_{\text{NWOM}} - 1.26$, $p < .001$) information. A second pilot study (n=114) was conducted to further refine the survey and to ensure that the constructs had sufficient reliabilities. At this stage, it was noticed that some participants finished the survey in a period of time that was not sufficient to carefully read the information in the vignette and to answer the survey questions that followed. Following this, timers were introduced in the survey whereby survey pages were made to stay for a fixed period of time before the participant could proceed further. Also, a cognitive elaboration question *what were your thoughts as you read the advertisement* was introduced in the survey besides a question to get the participant's feedback about the

survey. A third pilot (n=112) was conducted with the timers introduced and participant response to the survey questions and feedback on the survey were studied. The results showed that the constructs in the survey showed adequate reliabilities. Also, participant feedback did not indicate any issues with the survey questions. In the actual survey, both timers and check questions were used to ensure that the participants read and answered the questions in the survey.

Procedure

The actual survey was launched among members of an online consumer panel (Amazon Turk), in the lines of Angst and Agarwal (2009). A total of 585 usable responses were received. About 52 percent of the participants were female and all were based in US. At the start of the survey, participant's consent to participate was obtained. Subsequently, the participants were informed that there were no right or wrong answers and so were asked to respond with their true opinion to the questions in the survey. To ensure that all participants have a common understanding of what mobile health applications entail a brief overview on health apps was included in the survey. Further, to ensure that the participants do not skim through the information presented, the survey was programmed such that each page stays on the computer screens for a reasonably long time. Subsequently, the participants were randomly assigned to one of the four conditions – *positive message frame (gain frame) with positive word of mouth information, positive message frame (gain frame) with negative word of mouth information, negative message frame (loss frame) with positive word of mouth information, negative message frame (loss frame) with negative word of mouth information*. At the end of the treatment, participants responded to a survey.

Measures

The scale for perceived usefulness was adapted from Davis et al. (1989). Scale for intention to adopt was adapted from Venkatesh (2000). Scale for trust was adapted from Komiak and Benbasat (2006). Scale for Perceived congruence was adapted from Biswas et al. (2006). The manipulation check questions used for message framing and word of mouth were based on prior marketing studies (e.g. Maheswaran and Meyers-Levy 1990). The manipulation check questions were also used to operationalize the gain frame and word of mouth constructs. This is consistent with prior IS research that used the manipulation check scores to measure the independent variables (Komiak and Benbasat 2006). Congruence scale items were measured using a seven point Likert scale with anchors *Not at all* and *To a very large extent*. All other scale items were measured using a seven point Likert scale with anchors *Strongly disagree* and *Strongly agree*.

Control Variables

To rule out alternate explanations, I controlled for several key variables – *age, gender, level of education, race, income, health status (presence of any chronic illness), prior health app experience, attitude towards user reviews, health motivation, persuasion knowledge, consideration for future consequences and involvement with the topic of the survey.*

RESULTS

I used partial least squares (PLS) to test the proposed model (Smart-PLS software version 2.0.M3). PLS was chosen over LISREL/AMOS as the aim of this study is theory development and not theory testing (Komiak and Benbasat 2006), and PLS is better suited for exploratory research (Gefen et al. 2000). I first examined the measurement model before proceeding to test the structural model.

Measurement Model

As seen from Table 1, the composite reliability score of the scales was .95 or higher which suggests that the scales employed were reliable (Hair et al. 2009). The item loadings on their corresponding construct is greater than the loading on other constructs and thus the criteria for convergent validity is satisfied. The average variance extracted (AVE) was greater than .5 (Hair et al. 2009) and the squareroot of AVE (Table 2) was greater than the correlation among constructs, satisfying the discriminant validity criteria (Fornell and Larcker 1981).

Table1. PLS Path Loadings

Construct (Composite reliability)	Items	1	2	3	4	5	6
Trust (.95)	Trust1	0.96	0.18	0.68	0.69	0.63	0.80
	Trust2	0.97	0.20	0.70	0.71	0.62	0.81
	Trust3	0.92	0.17	0.59	0.65	0.56	0.75
Message Frame (.95)	MF1	0.19	0.95	0.07	0.20	0.06	0.19
	MF2	0.17	0.95	0.09	0.20	0.06	0.19
Word of Mouth (.99)	WOM1	0.69	0.09	0.99	0.60	0.73	0.69
	WOM2	0.67	0.09	0.98	0.57	0.70	0.66
	WOM3	0.70	0.09	0.99	0.60	0.73	0.70
	WOM4	0.69	0.08	0.99	0.59	0.72	0.68
Behavioral Intention (.99)	BI1	0.72	0.20	0.60	0.99	0.48	0.86
	BI2	0.70	0.22	0.59	0.99	0.47	0.86
Congruence (.98)	CON1	0.62	0.05	0.72	0.48	0.95	0.56
	CON2	0.60	0.07	0.67	0.45	0.97	0.55
	CON3	0.61	0.05	0.70	0.46	0.98	0.56
	CON4	0.63	0.08	0.74	0.48	0.98	0.58
Perceived Usefulness (.99)	PU1	0.80	0.19	0.68	0.85	0.57	0.96
	PU2	0.81	0.20	0.67	0.84	0.56	0.98
	PU3	0.81	0.20	0.67	0.85	0.56	0.98
	PU4	0.80	0.20	0.68	0.84	0.57	0.98

Table 2. Correlation Matrix

		Mean	SD	1	2	3	4	5	6	7	8
1	Age ¹	2.29	1.21	NA							
2	GNDR	0.52	0.5	0.11	NA						
3	Race	1.67	1.33	-0.10	-0.09	NA					
4	INCM	4.86	2.13	0.10	0.03	0.01	NA				
5	CHRN	0.63	0.48	-0.12	-0.15	0.14	0.12	NA			
6	HMOT	5.52	1.11	0.08	0.09	0.01	0.09	0.03	0.82		
7	EDUC	5.02	1.28	0.19	-0.03	-0.01	0.24	0.02	0.13	NA	
8	APEX	0.48	0.5	0.20	-0.10	-0.01	-0.10	-0.01	-0.24	-0.05	NA
9	CFFC	5.3	0.99	0.10	0.02	0.00	0.06	0.07	0.34	0.11	-0.02
10	IIMP	4.91	1.73	-0.01	0.18	0.05	0.09	0.03	0.52	0.07	-0.34
11	URAT	6.06	1.09	-0.01	0.09	-0.04	-0.03	-0.05	0.11	-0.04	-0.06
12	PERK	5.9	0.89	0.08	0.00	-0.01	0.04	0.05	0.23	0.03	-0.03
13	CONG	4.22	2.4	-0.05	-0.03	-0.04	-0.01	0.07	0.00	0.00	0.00
14	MSGF	5.17	1.69	0.07	0.09	0.02	-0.07	-0.01	0.10	-0.03	0.10
15	PUSE	3.66	2.15	-0.01	0.03	-0.01	-0.02	0.04	0.06	-0.02	-0.08
16	TRST	3.83	1.83	-0.03	-0.01	-0.01	0.00	0.09	0.09	0.02	-0.04
17	WOMT	4	2.83	0.01	0.02	-0.04	-0.02	0.03	-0.02	0.03	-0.02
18	BINT	3.36	2.23	0.03	0.06	0.03	-0.02	0.03	0.12	0.00	-0.10

		9	10	11	12	13	14	15	16	17	18
9	CFFC	0.74									
10	IIMP	0.16	0.93								
11	URAT	0.22	0.04	0.94							
12	PERK	0.39	0.07	0.24	0.83						
13	CONG	0.05	0.05	-0.13	0.04	0.97					
14	MSGF	0.16	0.04	0.09	0.13	0.06	0.95				
15	PUSE	0.09	0.21	-0.05	-0.06	0.58	0.20	0.98			
16	TRST	0.11	0.11	-0.04	-0.03	0.64	0.19	0.82	0.95		
17	WOMT	0.06	-0.03	-0.15	0.02	0.73	0.09	0.69	0.69	0.99	
18	BINT	0.13	0.29	-0.03	-0.03	0.48	0.21	0.87	0.72	0.60	0.99

Notes:

GNDR –Gender, INCM-Income, HSTA – Health Status, HMOT –Health Motivation, EDUC – Education, APEX – Health App Experience, CFFC – Concern for Future Consequences, IIMP – Issue Importance, URAT – Attitude towards User Reviews, PERK –Persuasion Knowledge, CONG –Congruence, MSGF – Message Framing, PUSE – Perceived Usefulness, TRST – Trust, WOMT – Word of Mouth, BINT – Behavioral Intention

¹- Age was measured in categories

Gender (GNDR) was coded as 0-Male 1-Female

Diagonal elements represent squareroot of average variance extracted (AVE)

Structural Model

To test for common method bias, in the lines of Venkatesh et al. (2012), I used Liang et al.'s (2007) approach of specifying a method factor in PLS and Malhotra et al.'s (2006) approach for post hoc estimation of CMV. Additionally, following Malhotra et al.'s (2006) recommendation, I also performed a CFA based Harmon's one factor analysis and tested for the model fit between a model with just one latent factor and the proposed model in AMOS. The results of these tests (Appendix E) show that CMV is less of a concern in this study. Further, to minimize multi-collinearity, I mean-centered the variables used to create the interaction term (Jaccard et al. 1990).

Following this, I ran the analysis and the results are presented here. Hypothesis H1 predicted that gain frame would influence perceived usefulness positively. The results indicate that gain frame was positively related to perceived usefulness and the relationship was significant (path =.05, $t=2.22$, $p<.05$). Hypothesis H2 predicted that gain frame and positive word of mouth would interact to positively influence perceived congruence. The results indicate that interaction was significant and as predicted (path =.139, $t=4.12$, $p<.001$). Hypothesis H3 predicted that perceived congruence would influence trust positively. The results indicate that perceived congruence was positively related to trust and the relationship was significant (path =.64, $t=21.61$, $p<.001$). Hypothesis H4 predicted that perceived congruence would influence perceived usefulness positively. The results indicate that perceived congruence was positively related to perceived usefulness and the relationship was significant (path =.095, $t=2.84$, $p<.01$). Hypothesis H5 predicted that trust would influence perceived usefulness positively. The results indicate that trust was positively related to perceived usefulness (path =.75, $t= 26.61$, $p<.001$). Hypothesis H6 predicted that perceived usefulness would influence intention to adopt positively.

The results indicate that perceived usefulness was positively related to intention to adopt and the relationship was significant (path =.81, t= 19.83, p<.001). Hypothesis H7 predicted that trust would influence the intention to adopt positively. The results indicate that this relationship was not significant (path =.03, t=.89, p>.05). The model could explain nearly 77 percent of variance in intention. Table 3 lists the path coefficients along with the t-statistic. The results of the hypothesis test are summarized in Table 4.

Post-hoc Analysis

Since the relationship from trust to intention was observed to be insignificant, I conducted a *post hoc* analysis (Appendix G) to observe any mediation effects of perceived usefulness. A Sobel test was performed to check for significance of the mediation relationship. Results show that perceived usefulness mediated the trust to intention relationship (Z=15.79; p<.001). Further analysis also revealed the mediating role of trust on the congruence to perceived usefulness relationship (Z=16.19; p<.001).

Table3. Path Coefficients

Path	Path coefficient	t-statistic	p-value (one-tailed)
GAIN → PU	.05	2.22	<.05
GAIN X WOM → CONG	.139	4.12	<.001
CONG → TR	.64	21.61	<.001
CONG → PU	.095	2.84	<.01
TR → PU	.75	26.61	<.001
PU → BI	.81	19.83	<.001
TR → BI	.03	.89	n.s.

Note:

GAIN – Gain Framing WOM – Word of Mouth CONG –Congruence TR – Trust PU – Perceived Usefulness BI – Behavioral Intention

DISCUSSION

The focus of this research was to examine whether message framing strategies could be used to drive consumer adoption of health apps and how effective such strategies are in the presence of word of mouth information. Recent research in IS suggests that positive message frames could drive adoption of health IT systems such as EHRs (Angst and Agarwal 2009). In this research I extend this finding to a mobile health context and in doing so also examine the role played by external sources of information such as user reviews, in influencing consumer decision making. The research findings suggest that positive message frames could be an effective way to drive adoption of health apps. Also, the congruence between the firm generated message and the user review was found to influence perception of trust and usefulness about the app. Trust was found to enhance perceptions of usefulness, which in turn influenced adoption intentions.

Theoretical Contributions

This research makes several key contributions to the literature. First, by integrating the message framing and word of mouth literature streams it advances current state of knowledge relating to both the streams as we can better appreciate what the effects of the interplay are. Second, by focusing on word of mouth related to healthcare, it also fills the gap in the WOM literature involving high involvement products (Gu et al. 2012) as most WOM research has involved low involvement products. Third, this is one of the first research studies in IS to study adoption from a processing fluency theory perspective. By integrating the processing fluency theory into the IS literature, this research advances our current state of understanding about how messages are processed and what the effects of such processing are on downstream consequences such as adoption. The findings can also have implications for how websites in

general should be designed and in particular health websites for easy assimilation of the health information by the customers. Finally, it adds to the growing body of IS research that examines the role of interventions such as message framing to drive technology adoption and usage. Given that there is little IS research on interventions, this research adds to this emerging pool of research (Venkatesh and Bala 2008). Further, Angst and Agarwal (2009) had suggested that there could be means other than attitude change through which message framing could impact intentions. By employing a trust and processing fluency perspective, this research shows that message framing interventions could also influence perceptions of usefulness.

Limitations and Future Research

As with all research the present research also has some limitations which are listed below. First, the study did not consider actual adoption behavior but only intention to adopt the health app. Future research must also consider actual adoption behavior beyond intentions. Second, the study did not factor in the role of individual differences such as regulatory orientation (prevention/promotion focus) (Higgins 1997) and consideration for future consequences (temporal orientation) (Joireman et al. 2006), which have been shown to be important factors that influence the efficacy of message framing strategies. For example, Kees et al. (2010) found that fit between goal pursuit strategy in the advertisement and consumer's regulatory focus to enhance the effectiveness of the advertisement. Also, Mann et al. (2004) showed that that health messages were likely to be more effective when they matched the dispositional motivation (approach/avoidance orientation) of the individual. Thus, future research must consider the role of individual differences in furthering our knowledge of interventions to drive health IT adoption. Third, this research does not delineate the intervening mechanisms through which message frame affects perceived usefulness. Thus, there is a

limitation in our understanding of the causal path through which message framing affects technology related beliefs. Future research must examine the underlying mechanisms through which message framing influences perceived usefulness. For example, it is possible that when the message framing fits with one's regulatory orientation, the individual is likely to be more involved and thus is likely to elaborate on the message compared to someone who does not perceive a fit. Thus, message elaboration could potentially be an intervening variable that mediates the effect of message frame on perceived usefulness. Fourth, the user reviews were either positive or negative. However, in a real world context, there are likely to be both positive and negative reviews. Thus we need further research to better understand the influence of such mixed word of mouth information on message framing strategies. For example, prior IS research suggests that trust and distrust are distinct concepts and not two ends of a continuum (Dimoka 2010). Thus it is possible that some user reviews (positive) could enhance trust perceptions and some other reviews (negative) could enhance distrust. Further research is required to understand how individuals reconcile trust and distrust in engaging in a transaction with an online vendor such as a, health app firm.

CONCLUSION

In response to the growing emphasis on health and wellness, a lot of firms are in the business of developing health apps that can assist consumers to self-manage their health and wellness. However, the adoption of health apps has been sluggish. The focus of this research was to examine whether health app firms could use interventions to drive health app adoption. Drawing on the rich stream of research on using messages frames to influence health behavior, this research examined whether messages that highlight the benefit of using the app could be used to influence consumer adoption of health apps. In doing so, this research also considered

the effect of word of mouth information (user reviews) in influencing the efficacy of message framing interventions. Results show that messages that are framed positively (highlighting the benefits of using the health app) influence perceptions of usefulness of the app. Further, when the user reviews are positive, the resulting congruence (similarity in what the firm claimed and what the user's actual experience was) influenced trust and perceptions of usefulness of the app. Trust was found to enhance perceptions of usefulness and usefulness perception in turn positively influenced the intention to adopt the app. The findings of this research suggests that message framing strategies could be used to drive health app adoption and also draws attention to the important role of user reviews in influencing adoption.

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APPENDIX A MEASUREMENT ITEMS

Behavioral Intention (*Strongly Disagree ... Strongly Agree*) (*Composite reliability-.99*)

1. Assuming I had access to the WeightKeeper app, I intend to use it
2. Given that I had access to the WeightKeeper app, I predict that I would use it

Perceived Usefulness (*Strongly Disagree ... Strongly Agree*) (*Composite reliability-.99*)

1. I find the app useful to manage my health
2. Using the app would increase my health management productivity
3. Using the app would increase my chances of achieving health goals that are important to me
4. Using the app would help me accomplish my health management activities more quickly

Trust (*Strongly Disagree ... Strongly Agree*) (*Composite reliability-.95*)

1. WeightKeeper is honest
2. I consider WeightKeeper to be of integrity
3. WeightKeeper provides unbiased facts about the app

Congruence (*Not at all ... To a very large extent*) (*Composite reliability-.98*)

1. How much in agreement were the Advertisement and the User Reviews?
2. How similar were the Advertisement and the User Reviews?
3. How congruent were the Advertisement and the User Reviews?
4. How much in sync were the Advertisement and the User Reviews?

Manipulation Check questions

Word of Mouth (*Strongly Disagree ... Strongly Agree*) (*Composite reliability-.99*)

1. The user reviews were in favor of the app
2. The user reviews were not in favor of the app (r)
3. Overall, the user reviews were positive
4. Overall, the user reviews were negative (r)

Message Frame (*Strongly Disagree ... Strongly Agree*) (*Composite reliability-.95*)

1. The message stressed the positive implications of using the WeightKeeper app
2. The message I read stressed the positive implications of managing body weight

APPENDIX B MESSAGE FRAME VIGNETTE

Gain Frame

Managing your body weight at the optimal level means a *more fit* YOU!

Staying in shape gives you *greater mobility, improved self-esteem and good health in general.*

You will also be *more* productive at work and home and *can* experience life to the fullest.

Further, *by keeping* your body weight under control you *decrease your risk* of contracting chronic diseases (e.g., *hypertension, diabetes, heart disease*)¹

You will save money on unnecessary hospital visits, co-pays and by not having to miss workdays. This means, a *higher quality of life*, overall!

The first step to *enjoying all the benefits* of *staying fit* is to be in control of your diet intake, physical activity and ensuring adequate rest. Our *WeightKeeper*TM app can assist you with this!

Using the app you can:

- Tracks diet, physical activity and rest
- Goal setting and goal planning assistance
- Insightful reports and feedback
- Customizable Reminders
- Integrates with other popular apps
- Large database of nutrition info & activity types
- Share progress details with whom you want

Embrace a more healthful life - try our app, today!

¹ *Center for Disease control Annual Report - 2013*

Loss Frame

Not managing your body weight at the optimal level means a *less fit* YOU!

Not staying in shape gives you *lower mobility, decreased self-esteem and poor health in general.*

You will also be *less* productive at work and home and *cannot* experience life to the fullest.

Further, *by not keeping* your body weight under control you *increase your risk* of contracting chronic diseases (e.g., *hypertension, diabetes, heart disease*)

You will lose money on unnecessary hospital visits, admissions, co-pays, lost days at work. This means, a *lower quality of life*, overall!

The first step to *avoiding all the problems of not staying fit* is to be in control of your diet intake, physical activity and ensuring adequate rest. Our *WeightKeeper*TM app can assist you with this !

Using the app you can:

- Tracks diet, physical activity and rest
- Goal setting and goal planning assistance
- Insightful reports and feedback
- Customizable Reminders
- Integrates with other popular apps
- Large database of nutrition info & activity types
- Share progress details with whom you want

Avoid a *less healthful life* - try our app, today!

¹ *Center for Disease control Annual Report - 2013*

APPENDIX C WORD OF MOUTH VIGNETTE

Positive Word of Mouth

USER REVIEWS	
<p>★★★★★ Fantastic app 841 users voted this review helpful</p> <p>Just what I wanted to manage my body weight issues. Great product and excellent response to any problems and suggestions from the company's support.</p>	
<p>★★★★☆ Love this app 380 users voted this review helpful</p> <p>Just *Love* the app. Helps me be in full control of my health through the day. Even my blood pressure has dropped since I started using this app. Thank you guys!!</p>	
<p>★★★★★ nice one ! 523 users voted this review helpful</p> <p>Recent improvements make this app run much smoother. Looks like the right tool for me and all my health needs</p>	
<p>★★★★★ Awesome app 569 users voted this review helpful</p> <p>A fabulous app that does what it says! I am very pleased with the app and its effect on my health and confidence. 5 stars!!</p>	
<p>★★★★★ cool stuff 427 users voted this review helpful</p> <p>Just, absolutely amazing. No longer do I need stacks and stacks of paper with only part of the information I need at a given point</p>	
<p>★★★★★ must have ! 710 users voted this review helpful</p> <p>Great app. I love it. Really helps you get motivated. I wouldn't mind at all paying for this app #Win</p>	

Source: Adapted from user reviews on <https://itunes.apple.com> and <https://play.google.com>

Negative Word of Mouth

<p>★ ★ ★ ★ ★ Avoid it!!!!</p>	841 users voted this review helpful
<p>This is the WORST app I have EVER used. Pretty amateur stuff. Avoid it and save your health</p>	
<p>★ ★ ★ ★ ★ painful app</p>	380 users voted this review helpful
<p>The phone often starts 'thinking' and then the app crashes. Contacted the support to fix it, no fix as yet to the issue. Several health data I keyed in are lost – irritating to re-type all over again. I could as well go back to pen and paper</p>	
<p>★ ★ ★ ★ ★ not user friendly</p>	523 users voted this review helpful
<p>Two months since I downloaded this app. Still not comfortable with even the basic functions in the app – anything but user friendly. App101: Make apps that people want to use</p>	
<p>★ ★ ★ ★ ★ it's a CRAPP</p>	569 users voted this review helpful
<p>Just a bunch of tall claims – please remove this app from the list before any more users fall victim for this crap app</p>	
<p>★ ★ ★ ★ ★ poorly built app</p>	427 users voted this review helpful
<p>I wish the app just did one of diet tracking, activity tracking or sleep tracking effectively. Right now it's just kid stuff in all departments – even basic features are pretty naïve</p>	
<p>★ ★ ★ ★ ★ # fail</p>	710 users voted this review helpful
<p>Rubbish... what makes these guys think I would spend 10 minutes searching and keying in every food or physical activity? The database is so useless - without a comprehensive library of food and physical activity it is a pain to use this app.</p>	

Source: Adapted from user reviews on <https://itunes.apple.com> and <https://play.google.com>

APPENDIX D COMMON METHOD BIAS ANALYSIS

Following Venkatesh et al. (2012), I used the method recommended by Malhotra et al. (2006) and Liang et al. (2007) to test for common method variance. First, I used Liang et al.'s (2007) unmeasured latent variable technique to assess common method bias. The average variance explained by the method factor was under .01 and that explained by the substantive factor was around .95 (See Table D1).

Second, using Malhotra et al.'s (2006) approach I identified the second smallest positive correlation (.045) and deducted this value from all correlations. When the analysis was conducted again no major difference was observed between the original and adjusted correlation estimates. All but one correlation continued to be significant even after partialing out the effect of the marker variable.

Third, following Malhotra et al.'s (2006) recommendation, I also performed a CFA based Harmon's one factor analysis and tested for the model fit. The model fit for the model with a single factor was worse as it had poor goodness of fit indices. The proposed model had excellent goodness of fit indices.

Thus, overall, CMV appears to be less of a concern in this study.

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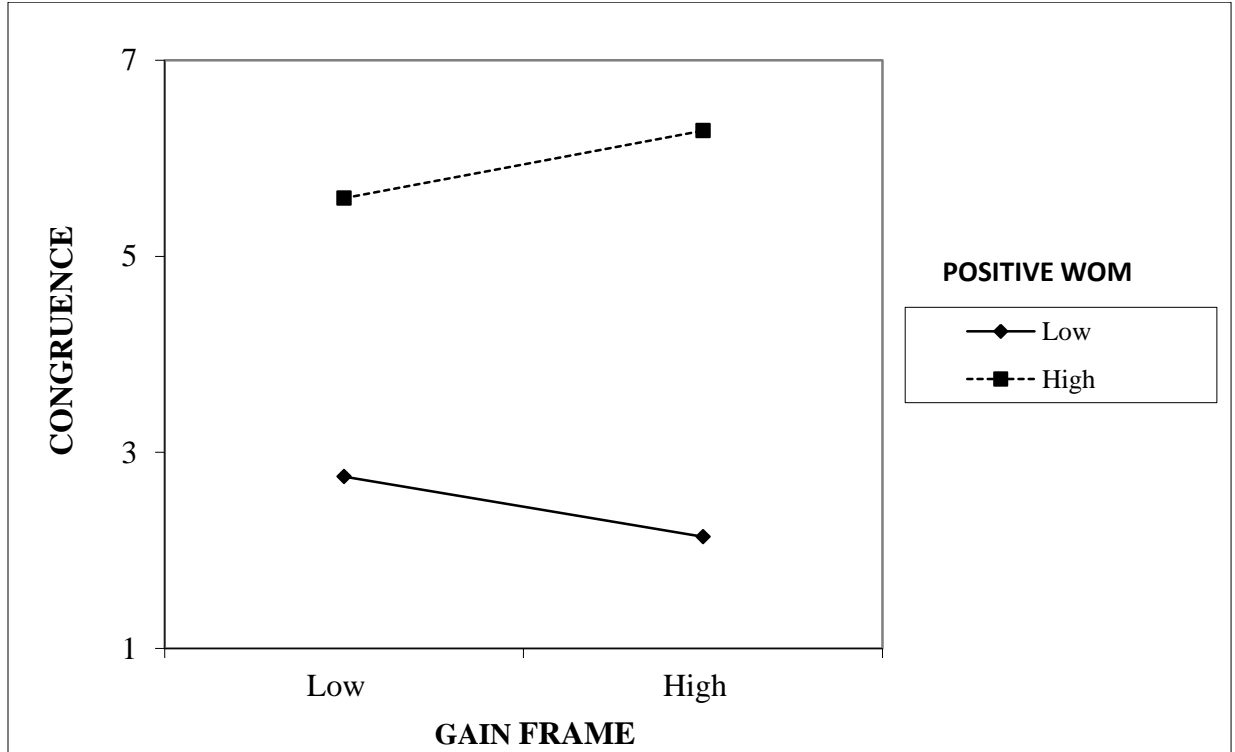
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Table D1. Average Variance Explained

	Substantive factor loading	Squared Loading	Method factor loading	Squared Loading
BI1	0.98	0.95	0.02	0.00
BI2	1.01	1.01	-0.02	0.00
Trust1	0.92	0.85	0.05	0.00
Trust2	0.92	0.84	0.06	0.00
Trust3	1.02	1.04	-0.11	0.01
PU1	0.91	0.83	0.06	0.00
PU2	1.01	1.01	-0.03	0.00
PU3	1.01	1.03	-0.04	0.00
PU4	0.97	0.94	0.01	0.00
CON1	0.92	0.85	0.04	0.00
CON2	1.01	1.03	-0.05	0.00
CON3	1.00	1.00	-0.03	0.00
CON4	0.95	0.90	0.04	0.00
MF1	0.95	0.90	0.00	0.00
MF2	0.95	0.90	-0.05	0.00
WOM1	0.97	0.94	0.02	0.00
WOM2	1.03	1.07	-0.06	0.00
WOM3	0.95	0.91	0.04	0.00
WOM4	1.00	0.99	-0.01	0.00
	Variance explained	0.95		0.002

APPENDIX E INTERACTION PLOT

Gain Frame Vs Word of Mouth on Congruence



APPENDIX F MEDIATION TEST

IV	M	DV	IV → DV	IV → M	IV + M → DV		Mediation
					IV	M	
TR	PU	BI	.696***	.754***	.034	.812***	Full
CONG	TR	PU	.567***	.635***	.095**	.754***	Partial

Note:

1. *** Significant at the .001 level ** Significant at the .01 level
2. CONG – Perceived Congruence
3. TR – Trust
4. PU – Perceived Usefulness
5. BI – Behavioral Intention

Sobel Test

Test-1: Trust → Behavioral Intention mediated by Perceived Usefulness

Test	Path	Beta	S.E.	T-Stat	Path	Beta	S.E.	T-Stat
TR → PU → BI	TR → PU	.754	.03	26.61	PU → BI	.812	.04	19.83

Sobel test

Z-statistic = 15.79, P<.001

Note:

1. CONG – Perceived Congruence
2. TR – Trust
3. PU – Perceived Usefulness
4. BI – Behavioral Intention

Test-2: Congruence → Perceived Usefulness mediated by Trust

Sobel Mediation Test								
Test	Path	Beta	S.E.	T-Stat	Path	Beta	S.E.	T-Stat
CONG → TR → PU	CONG → TR	.635	.03	21.61	TR → PU	.754	.03	26.61

Sobel test

Z-statistic = 16.19, P<.001

Note:

1. CONG – Perceived Congruence
2. TR – Trust
3. PU – Perceived Usefulness

APPENDIX G RESEARCH COMPLIANCE PROTOCOL LETTER

December 20, 2012

MEMORANDUM

TO: S. Sankara Subramanian
Fred Davis

FROM: Ro Windwalker
IRB Coordinator

RE: New Protocol Approval

IRB Protocol #: 12-12-340

Protocol Title: *Health Apps Study*

Review Type: EXEMPT EXPEDITED FULL IRB

Approved Project Period: Start Date: 12/20/2012 Expiration Date: 12/19/2013

Your protocol has been approved by the IRB. Protocols are approved for a maximum period of one year. If you wish to continue the project past the approved project period (see above), you must submit a request, using the form *Continuing Review for IRB Approved Projects*, prior to the expiration date. This form is available from the IRB Coordinator or on the Research Compliance website (<http://vpred.uark.edu/210.php>). As a courtesy, you will be sent a reminder two months in advance of that date. However, failure to receive a reminder does not negate your obligation to make the request in sufficient time for review and approval. Federal regulations prohibit retroactive approval of continuation. Failure to receive approval to continue the project prior to the expiration date will result in Termination of the protocol approval. The IRB Coordinator can give you guidance on submission times.

This protocol has been approved for 1,350 participants. If you wish to make *any* modifications in the approved protocol, including enrolling more than this number, you must seek approval *prior to* implementing those changes. All modifications should be requested in writing (email is acceptable) and must provide sufficient detail to assess the impact of the change.

If you have questions or need any assistance from the IRB, please contact me at 210 Administration Building, 5-2208, or irb@uark.edu.

**ESSAY 3: ROLE OF SYSTEM DESIGN IN FOSTERING CONSUMER USAGE OF
HEALTH IT SYSTEMS: A STUDY IN THE CONTEXT OF ONLINE PATIENT
COMMUNITIES**

ABSTRACT

Online communities that bring patients with similar conditions together are growing in popularity and are called online patient communities (OPC). Fostering active collaboration among the OPC members is a major challenge. This research examined the role of system design in influencing seeking and sharing of health related support among members of OPCs. In light of the growing emphasis on giving consumers control over their health information, this research theorized a new type of system design called *selective-anonymous* system which lets the users choose whether to be anonymous or non-anonymous in using the OPC as a way of enhancing seeking and sharing of support in OPCs. In a scenario-based repeated-measures quasi-experiment involving 462 participants from an online consumer panel, this study examined the influence of three types of OPC system design – *non-anonymous*, *anonymous* and *selective-anonymous* – on member willingness to seek and share health related support. OPC systems that afford user control were found to be better than non-anonymous systems in influencing both seeking and sharing of support. However, interestingly, selective-anonymous systems were not any better than anonymous OPC systems in influencing seeking and sharing of support. Implications for research and practice are discussed.

INTRODUCTION

“Patients can share their stories, learn from others, spread knowledge, and instill hope.”³

Social media has been assuming an increasingly prominent role in the healthcare domain in facilitating provider – patient engagement (Chan et al. 2012; Cyr 2012). For example, health institutions such as Beth Israel Deaconess Medical Center and Kaiser Permanente regularly post updates on the developments in the hospital and also health related alerts and tips through their Twitter account. Also, many hospitals have active blogs through which physicians engage with the patient community (e.g., Mayo Clinic’s *Physician Update Blog*). Another health IT system that consumers are increasingly leveraging on is the online patient community (OPC). OPCs are online communities that bring patients with similar conditions together to facilitate exchange of health information and social support (Han et al. 2010; Leimeister and Krcmar 2006; Owen et al. 2010; Rodgers and Chen 2005; Wang and Chen 2011; Wen et al. 2011). The ability to connect with others with similar health conditions can help patients to assess their own progress as well as help others (Misra et al. 2008; Wicks et al. 2011). Besides, considering the poor health literacy rate in the U.S. (Oates and Paasche-Orlow 2009), online communities may serve as a source of health informational support as well. As indicated in the epigraph (from a physician), even some in the medical fraternity have been encouraging patient usage of OPCs as a way to tap into the social support afforded by these settings. While OPCs have several benefits associated with their usage, they can also expose the users to vulnerabilities such as loss of reputation (Jarvenpaa and Majchrzak 2010) and loss of privacy associated with revealing one’s health related information (Anderson and Agarwal 2011). It is possible that fear of such vulnerabilities could prevent

³ Source: <http://www.quantiamd.com/q-qcp/DoctorsPatientSocialMedia.pdf>

people from effectively seeking support for their specific health related needs and concerns. Against this backdrop, it is not clear how well the members who adopt (join) these health communities are able to derive health benefit in terms of drawing informational and social support. Prior research also suggests that a large proportion of online community members could be merely lurking (Malik and Coulson 2011; Nonnecke 2000; Nonnecke and Preece 2000; Ridings and Wasko 2010), whereby they passively draw informational benefits from the community's postings without actively contributing to it. While lurking behavior can help the focal individual to gain access to information that has already been shared in the community, it restricts the ability of the *lurker* to gain access to information that one requires for his or her specific health condition or to seek social (emotional) support (Liu and Chan 2010; Mo and Coulson 2012; Shpigelman et al. 2009) at times of need. Given that social support has been found to be associated with "better coping, improved quality of life and reduced levels of psychological distress" (Jia et al. 2004; Mo and Coulson 2012 p. 446), it is possible that lurkers may not be able to tap in to these benefits. Also, considering that one of the reasons some people lurk is on account of poor activity on the community or no responses to one's postings (Arguello et al. 2006; Preece et al. 2004), it is possible that lurking behavior could have cascading effects for the community as a whole. Hence, there is a need to identify interventions that can enhance member's active participation in OPCs beyond mere lurking. Research on online communities also suggests that there is a lot of membership turnover (e.g., Faraj et al. 2011) in these settings including online health communities (Ridings and Wasko 2010). While such flux in membership can be helpful in terms of bringing in new patients and newer experiences along, for the focal patient (who leaves) it could mean a lost opportunity to use the group to draw support and

receive health information benefits (Nambisan 2011). Thus, engaging members and fostering usage of OPCs is critical. However, our knowledge of interventions that can help foster usage of OPCs is limited.

Presently, online health communities employ different types of system design to foster user participation. For example, *PatientsLikeMe.com*, exposes username and all the associated user profile information (such as afflictions, treatments) with all of one's postings. *Healthtap*, another popular online health community, makes all of one's posting anonymous by default. We do not have a clear understanding of what the actual impact of the system design (anonymous/non-anonymous) on the user's intentions to participate is and what mechanisms underlie such effects. Such knowledge can help design communities that serve the interest of the patient community well by facilitating enhanced participation. Recent research has shown that consumers prefer granular control over their health information (Caine and Hanania 2013) whereby they have a control over how their health information is handled (Anderson and Agarwal 2011). Also, the fair information practices (FIP) from the Office of National Coordinator for Health IT and the US Department of Health and Human services emphasizes on *individual choice* as a consideration in the design of health IT systems. In a OPC context, granular control and individual choice would mean consumers having the choice to be anonymous or non-anonymous. Given that systems to date have largely been either anonymous or non-anonymous, our understanding of the consequences of users having control over their identity is limited. In particular in the context of OPCs, we do not yet know how affording control to the users might in turn affect their usage of the system. Hence, the focus of this research is to understand how systems that afford control to the users compare to anonymous and

non-anonymous systems in terms of their effect on usage of the system. In doing so, this research also answers recent call in the literature for research on how OPC systems must be designed (Fichman et al. 2011).

This research advances extant IS research in three ways. First, with some exceptions (e.g., Quigley et al. 2007), prior IS research has largely focused on understanding the *information sharing* behavior (e.g., Ma and Agarwal 2007; Wasko and Faraj 2005) and not as much on the *information seeking* behavior, which is also important for a community to thrive and importantly for patients to benefit from. While lurking behavior can help the focal individual to gain access to information that has already been shared in the community, it restricts the ability of the *lurker* to gain access to information that one requires for his or her specific health condition or to seek social support (Liu and Chan 2010; Mo and Coulson 2012; Shpigelman et al. 2009) at times of need. Given that social support is associated with “better coping, improved quality of life and reduced levels of psychological distress” (Jia et al. 2004; Mo and Coulson 2012 p. 446), it is possible that lurkers may not be able to tap in to these benefits. Thus, there is a gap in our understanding of the various factors that can influence knowledge (information) seeking behavior. This research attempts to address this gap in our understanding by examining the differential effects of system design on both health information seeking and sharing behavior. Second, this research advances theory by integrating two well established literature streams, loafing and silence which have to the best of my knowledge despite their conceptual complementarity have continued to be studied in silos. Extant IS research has viewed failure to participate in a knowledge/information sharing activity as a case of intentional free-riding. For example, recently IS researchers have employed the lens of social loafing to understand member

failure to contribute to a collaboration activity such as a brainstorming session (Chidambaram and Tung 2005). Subsequent research by Alnuaimi et al. (2010) and Srinivasan et al. (2010), goes a step further and uses the lens of moral disengagement (Bandura 1979) to better understand the loafing behavior. While this stream of IS research has enriched our understanding of factors that might drive non-participation, the present research makes the case for taking a different perspective at the non-contribution behavior. Considering that in the broad academic literature, moral disengagement lens has been used to study deviant behaviors including extremism, this research makes the case that some alternate theories that do not typecast non-contribution/participation as an immoral behavior would be more appropriate to design interventions to encourage participation. Specifically, by drawing on the rich stream of research on employee silence in OB (Tangirala and Ramanujam 2005), this research argues that member non-contribution or failure to *speak up* could also be on account of concerns about consequences to self. Third, recent IS research (Anderson and Agarwal 2011) examined individual's willingness to share (provide access to) personal health information by considering the influence of type of information requested, the requesting stakeholder and the intended purpose on member willingness to share health information. The present research extends this research by factoring in the role of *system design* also in influencing both willingness to share and seek health information (support).

In the following sections, I present the relevant background literature, theory, hypothesis and the methodology that will be adopted to test the hypothesis.

THEORETICAL BACKGROUND

Online Communities

Prior IS research on online communities has focused on factors that drive members to *contribute*, such as identity verification (e.g., Ma and Agarwal 2007), social capital gains (e.g., Wasko and Faraj 2000), social exchange (Faraj and Johnson 2011) and self-interest (Lakhani and von Hippel 2003). Recent research by Faraj et al. (2011) has argued that fluidity inherent in these communities is another important aspect to be paid attention to which has been overlooked earlier. Broadly drawing on this rich body of prior literature, one would expect that in an online community such as OPC, if a member could establish their identity with their contributions and thus enhance their chance to derive social or identity capital, their contribution to the community would be greater. In other words, ability to establish one's identity (Ma and Agarwal 2007) is vital to enhance sharing behavior. This is in line with extant research in IS brainstorming that has shown that anonymity (or the lack of scope for establishing one's identity with one's contributions) could lead to withdrawal behaviors such as lowered contribution to a group activity such as brainstorming (e.g., Alnuaimi et al. 2010; Chidambaram and Tung 2005), termed as loafing behavior (Latane et al. 1979). However, recent IS research has also shown that health related information is associated with high levels of privacy concerns (Anderson and Agarwal 2011; Bansal et al. 2010) and that there could be resistance associated with sharing it. In an OPC context, this means the ability to be anonymous may encourage members to participate in the community. This is in line with research on employee silence, which has shown that individuals may avoid voicing their opinion or knowledge when they fear adverse consequences (Tangirala

and Ramanujam 2008) to self. Thus, extant research does not offer a clear guidance on which design feature (anonymity/non-anonymity) would result in high levels of usage of the OPCs.

Online Patient Communities

Online patient community (OPC) is a type of online community that seeks to bring patients with similar conditions together to facilitate sharing of health related information, personal health experiences and social support (Han et al. 2010; Owen et al. 2010; Wen et al. 2011; Wright et al. 2010). OPCs are also referred to as virtual health community (e.g., Eysenbach 2004), online health community (e.g., Nambisan 2011), online support groups (e.g., Han et al. 2010) and healthcare social media (e.g., Chan et al. 2012). The emphasis in OPC is on “mutual problem solving, information sharing, expression of feelings, mutual support and empathy” (Demiris 2006 p.179). By using the features of the OPC such as forums, private messaging and comments patients can discuss on health related issues (Frost and Massagli 2008) with other members and in the process receive and share informational and emotional support (Shpigelman et al. 2009) to cope up with one’s health condition. In studies conducted across various health communities such as those dedicated for cancer (e.g., Balka et al. 2010; Han et al. 2010; Wen et al. 2011), parkinson’s disease (e.g., Attard and Coulson 2011), obesity (e.g., Ballantine and Stephenson 2011), irritable bowel syndrome (e.g., Coulson 2005), social support (e.g., Barak et al. 2008; Ussher et al. 2006; Wang and Chen 2011; Wangberg et al. 2008) and perception of empowerment (e.g., Oh and Lee 2012) were found to be the important benefits that participating members perceived. In a study of cancer patients to understand how these communities facilitate overcoming social isolation, Hoybye et al. (2005) found that the exchange of knowledge and experience empowered the participants. Besides drawing emotional support,

research shows that members of OPCs use these community to express their feelings (e.g., Wangberg et al. 2008), share perspectives on drugs they had tried which are yet to be approved for treatment (Wicks et al. 2011), prepare for a medical appointment (Hu et al. 2012), get help in interpreting treatment related data and gather various perspectives on treatment options (Cyr 2012). In terms of health and wellness outcomes, research has shown that usage of online health tools can have several positive effects such as overcoming isolation (Hoybye et al. 2005), improved weight loss (Tate et al. 2003), treatment of depression (Houston and Cooper 2002), enhanced self-care self-efficacy, enhanced quality of life (Mo and Coulson 2012), and improved medication adherence (Luszczynska et al. 2007). Some research has also found that moderated online health groups tend to engage in more participation than the unmoderated groups (e.g., Ryan 2006). As with online communities in general, online patient communities are also characterized by high rates of lurking behavior (Ridings and Wasko 2010).

Lurking Behavior

Because member contributions are vital for the sustenance of any self-organizing group, in an online community context non-contributors are termed as *lurkers*. In the literature, a lurker has been defined as one who has “never taken a participatory action“(Bishop 2007 p.1882) and as one “who has never posted in the community” (Preece et al. 2004) in which one is a member. Essentially, lurkers are community members who extract informational benefits from the community’s postings but do not contribute back by actively participating or helping others. In a healthcare context this would mean, members seek information about illness and treatment options from prior postings available in the community but do not share their knowledge (health information) or emotional support to others. In healthcare community context research shows

that even lurkers are accepted as members of the community (Maloney-Krichmar and Preece 2004). This could mean that, if members who are lurkers choose to seek the community's help, they are likely to receive the community's support as they are also perceived as the group's members. There have also been studies to determine whether lurking is a trait or a state. Muller (2012) based on a study of contribution behavior to enterprise social media proposed that trait can partially determine contribution (or lurking) behaviors and that the individual's disposition toward a topic, work task or the group can modify it. In trying to examine the reasons for lurking behavior, Preece et al. (2004) classified the reasons cited by the respondents in to categories such as, *not having a need to participate, wanting to learn more about the community, perceptions of helping the group by abstaining from posting, challenges with using the system, and dislike for the community/group*. Some of the actual reasons (responses) include “*shy about posting*”, “*want to remain anonymous*”, “*received a rude response to a past post*”, “*I feel like I will just post something stupid*”, “*fear of harm*” among others (Preece et al. 2004). Thus, lurking could also be a result of fear of adverse consequences to self from posting to community. Based on the above discussion it is clear that while lack of motivation or interest might be one reason to lurk, fear of adverse consequences could also influence members to not engage with the community. Thus, it is reasonable to classify lurking behavior as comprised of *intentional free-riding behavior* and a *forced free-riding behavior*. *Intentional free riding behavior* is likely to be at play when a member has the relevant information or experience that could help a requester and yet the member chooses not to help (make a posting) in the community as “everyone's responsibility is no one's responsibility”. This behavior has also been termed as loafing behavior in the literature (Latane et al. 1979). A *forced free-riding behavior* is likely to be at play when an

individual has a need for seeking support or is capable of sharing support but does not do so for fear of adverse consequences such as privacy loss. Such a form of behavior has been termed as silence behavior in the literature (Johannesen 1974). Given recent research finding that lurkers can also be motivated to contribute to the community (Farzan et al. 2010), I present an overview of the social loafing and silence literature streams in identifying interventions to enhance member participation in OPCs.

Social Loafing

Social Loafing (Latane et al. 1979) refers to the shirking behavior that individuals engage in when working in groups. The phenomenon of social loafing has been examined extensively in the social psychology literature (e.g., Kerr and Bruun 1983; Jackson and Williams 1985; Williams et al. 1981) and increasingly in IS research in the context of virtual teams (e.g., Chidambaram and Tung 2005). In the context of electronic brainstorming there have been several studies in the literature (e.g. Chidambaram and Tung 2005; Gallupe et al. 1992; Valacich et al. 1992). The research by Chidambaram and Tung (2005) showed that as team size and dispersion increase incidence of social loafing also increases in CMC teams. That is when member's contribution or effort level cannot be uniquely ascertained, loafing behavior is likely to surface. This finding was also observed in a subsequent study by Alnuaimi et al. (2010). In summary, it could be said, that conditions such as anonymity where individual actions and efforts cannot be measured, are potential grounds for reduction in effort and consequently for social loafing to surface.

Silence

In the context of workplace settings, Johannesen (1974) defines silence as an employee's intentional withholding of information from others. Morrison and Milliken (2000) have argued that it is not an *unintentional failure* to communicate but a *conscious decision* to holdback suggestions, concerns or questions and that silence is a powerful force in organizations. They define silence as a communication behavior that involves suppression of concerns and opinions. Van Dyne et al. (2003) propose that silence behavior can be engaged in by different actors and can be directed towards different targets. Silence could be on issues such as “conflicts with coworkers, disagreement with organizational decisions, personal knowledge of potential weaknesses in work processes, concern about illegal behaviors and individual grievances” (Tangirala and Ramanujam 2008 p. 37). While silence behavior is beneficial in terms of reducing information overload on managers (Van Dyne et al. 2003) it is a detrimental phenomenon (Morrison and Milliken 2000) as it prevents critical information from reaching the decision makers (Tangirala and Ramanujam 2008) in time.

Contextualizing the above findings to an OPC context, members may engage in silence behavior when they foresee a risk to themselves from voicing a concern or opinion. While, member failure to voice might help reduce information overload in the community, it is also possible that some valuable and unique knowledge that could be of high utility to another member could be lost. A serious consequence to the focal member (as a result of engaging in silence behavior) is that they might not voice their health related concerns or seek assistance when needed. In summary, because it is the fear of consequences of expressing oneself that

causes silence behavior to surface, it is reasonable to infer that anonymity might be a way to tackle silence behavior.

THEORY AND HYPOTHESIS DEVELOPMENT

The goal of this research is to identify a theory guided intervention that can maximize individual's support seeking and sharing behavior in OPCs. Support that is shared and sought through OPCs can comprise of both informational and social (emotional) dimensions (e.g., Liu and Chan 2010; 2011). Prior research has defined *information support seeking* as individual's willingness to seek suggestion, advice and information from others (Cohen and Wills 1985; Israel 1985) & *emotion support (social support) seeking* as the individual's willingness to seek affect, esteem and concern from others (Cohen and Wills 1985; Israel 1985). In this research I focus on *support seeking and support sharing behavior* in general. I define *support seeking behavior as the individual's act of seeking informational and social (emotional) support from the community members*. Similarly, I define *support sharing behavior as the act of sharing informational and emotional support with the community members*.

The primary purpose of OPC is to facilitate easy seeking and sharing of health related support between individuals (patients). Thus, for an OPC to be effective, two things are fundamental. *First*, individuals must seek support when they need. As already argued, while lurking behavior can help a community member to leverage on the health information or advice already available in the community's postings, it limits the extent to which an individual could seek specialized support for one's specific health condition that has not already been addressed by the community. Besides, considering that unlike health websites, one of the unique features of these communities is the opportunity to seek social support (Hu et al. 2012; Hoybye et al. 2008;

Ussher et al. 2006) lurking behavior will limit the extent to which an individual can seek the social support benefits. Other community members can offer *affect, esteem and concern* (Cohen and Wills 1985; Israel 1985) to the focal member only if they disclose their health concern through active participation in the community. *Second*, members who have the expertise by way of knowledge of actual health experience must share it with individuals who seek support. While access to an IT system such as OPC makes seeking and sharing support easier, there are other factors that could determine whether one would make use of the system to seek and share support. One of the most critical factors is an individual's privacy concerns associated with sharing health related information (e.g., Anderson and Agarwal 2011; Bansal et al. 2010). Prior research shows that individuals have concerns about sharing their health information (Anderson and Agarwal 2011). Thus it is possible that, although the OPC system offers Martha the opportunity to tap in to the collective experience and social support from the community, owing to the privacy concerns she might not seek the support by exposing her specific health condition.

Loafing-Silence Paradox

A simple solution to encourage Martha to seek health related support might be to make the OPC system anonymous. Prior research in CMC brainstorming supports this logic as anonymous systems can facilitate participation without concerns such as evaluation apprehension (Diehl and Stroebe 1987) or having to conform to norms. However, research also tells us that in a collective where individual contributions cannot be uniquely ascertained, as is the case in an anonymous setting, members could cut back on their efforts (e.g., Chidambaram and Tung 2005). This means while individuals who need health related support might willingly seek using the anonymity available in the system, they *may* not receive the community's assistance in return

or in as good a measure as what they might in a non-anonymous setting. This is because of the potential loafing behavior that could set in on the part of people who possess the information or experience to offer help (Latane et al. 1979). To counter this, the OPC could be designed to be non-anonymous. Any attempt to encourage member contribution by making the user identities non-anonymous is associated with potential for social capital gains (Wasko and Faraj 2005) and hence there is a greater likelihood of members sharing their expertise and experience, to the extent that it does not compromise their own privacy or reputation. However, it is possible that, on account of the identified condition, members who need support may resist voicing their concerns, as voicing could expose their health condition along with their identity to others. In other words, a silence behavior (Morrison and Milliken 2000) could set in. This is particularly likely when the health condition is about sexual or mental health as against common health disorder such as seasonal flu⁴. Thus trying to limit one behavior (loafing) could inadvertently give rise to the other (silence). An alternative to counter this would be to make all support seeking activities anonymous and all support sharing activity non-anonymous. While, this could largely help improve member willingness to share, it is possible that some member contributions might be sensitive as it might involve revealing one's own mental or sexual health condition in offering support. And so, it is possible that such members although interested in helping, may choose to remain silent. The active supporters (Ballantine and Stephenson 2011), who are highly motivated to help might share their health information and experience even if it is sensitive, which could in turn jeopardize their own standing in the community (Jarvenpaa and Majchrzak 2010). Thus, paying attention to only determining whether a system must be anonymous or non-

⁴ For some individuals all health information may be of high privacy concern, in which case even common health related concerns may not be voiced in the community under identified condition.

anonymous, in isolation could result in sub-optimal outcomes for the individual and the community at large. An ideal approach would be to consider the individual user's needs and context in determining the appropriate technology design. Also, in light of recent work by Jarvenpaa and Majchrzak (2010), it is important to empower the users to minimize member exposure to vulnerability in the course of interaction with the OPC members. This research specifically focuses on member non-participation arising from fear of adverse consequences and lack of any perceived benefits to self. Hence the purpose of this research is to identify theory guided interventions to create conducive conditions whereby members can overcome such barriers to participate in the community (to seek or share support).

Need for User Control Over Identity

Faraj et al. (2011) introduced the notion of fluidity to characterize the dynamic changes in an online community's composition. Fluidity is defined as the fundamental characteristic of online communities and refers to the highly flexible or permeable boundaries of online communities (Faraj et al. 2011). Fluid online communities are characterized by continuous change over time of boundaries, norms, participants, artifacts, interactions and foci. They are also adaptive to the changes in "attention, actions and interests of the collective of participants" (p.3) in the community over time. Building on this notion of fluidity of online communities, I argue that fluidities exist at a more micro-level – i.e., at the individual level as well and that there is a need to understand these fluidities for fostering greater community engagement and contribution. In particular, I propose that *fluidity of member roles* (health support seeker/contributor), *fluidity of member need for anonymity* (wanting to be identified/anonymous), *fluidity of nature of support* (relating to normal health conditions such as allergies/

sensitive health condition such as relating to mental or sexual health), and the interplay between these fluidities needs attention to be able to design appropriate technology interventions to foster greater collaboration in OPCs. In other words an individual's choice to remain anonymous or be identified could be a function of three factors: (i) whether one is seeking or sharing support; (ii) whether the nature of the support relates to normal or sensitive health condition; and (iii) one's own preference for anonymity, which is a function of one's privacy concerns (Anderson and Agarwal 2011) and preference for social capital (Wasko and Faraj 2005). For instance, an individual who prefers to be anonymous for a particular support episode (e.g., asking for help to overcome mental stress) might want to express one's identity at another support episode (e.g., offering coping support to a terminally ill member), as a function of various factors. In the following sections I elaborate on the various factors that can influence member need for anonymity and identity by building on the notion of fluidity.

Fluidity in User Roles

Participants in an OPC can both give and seek health support as every user who gives advice is also a potential patient who may need help and assistance at a different point time. Referring to this dual role, Chan et al. (2012) refer to the users of OPC as *patient-users*. Viewing collaboration predominantly in terms of *contribution/sharing*, extant research has largely overlooked the equally important aspect of collaboration namely, seeking behavior (cf. Liu and Chan 2010; Quigley et al. 2007). Besides sharing behavior, a focus on seeking behavior is important because collaboration is a two-way process and members in a community are likely to share their opinions and experiences or offer emotional support in response to a request from another member. For example, several community members (fellow patients) may come together

in consoling or offering explanations and may suggest potential cures for one who has skin rashes. The action that is likely to initiate this collaboration is the patient or the focal individual asking for help in the first place. The reason the individual asked for help is unlikely to be to establish identity (Ma and Agarwal 2007) or to gain social capital (Wasko and Faraj 2005), which extant research has identified as potential drivers of collaboration. On the contrary, in the case of health issues, prior research would tell us that individuals would be concerned about their identity being revealed along with their health information (e.g., Anderson and Agarwal 2011). Therefore the factors that prior research has identified as drivers of collaboration in online communities could turn out to be the very reasons for collaboration failing in an OPC context. It is possible that a different set of drivers are at play that are related to the *seeking* aspect of collaboration in OPCs, which prior research has failed to pay sufficient attention to. Also, some individuals might be willing to engage in the *sharing* aspect of collaboration but not in the seeking dimension of collaboration for concerns such as exposing their ignorance to the community (e.g., Preece et al. 2004) among other reasons. For example, consider an individual who has established his or her identity as a fitness expert and perceives the community to have verified this identity (Ma and Agarwal 2007). Such an individual will be constrained to seek health assistance as it could undermine his or her standing and identity built over time. In turn, this could affect the intention to use the OPC to seek information or assistance. While the fitness expert might engage in lurking and attempt to draw support information already contained in the community, the information content in the OPC might not be of much help if the trainer has a unique health condition not addressed by prior postings in the community. Besides, lurking does not give access to the most fundamental offering of OPCs, i.e., social support. Therefore,

distinguishing between these two classes of activity comprising collaboration (i.e., support seeking and support sharing) is necessary to advance the existing knowledge on collaboration in online communities in general and OPCs in particular. The classification into support seeking and support sharing activities would also provide an understanding of ways to foster great participation in OPCs.

Fluidity in Type of Information

Support that is sought and shared in an OPC, while being related to health, could be of different levels of sensitivity. For example, it could be about common ailments such as seasonal allergy or about mental health concerns, which are more sensitive. Depending on the nature of the health condition involved, individuals may decide whether to use the OPC (to seek or share relevant health support) or not. Prior research has largely considered information that is shared and sought as being a monolithic unit and has not paid sufficient attention to the *nature of the information* involved. Exposing information about sensitive health conditions, such as those related to mental or sexual health, is likely to subject one to a greater degree of vulnerability in terms of loss of reputation or privacy (Jarvenpaa and Majchrzak 2010) than exposing information about common ailments, such as allergies. By not considering this potential for information to be high or low on sensitivity, researchers could be misled into designing interventions that may have undesirable effects or identifying mechanisms underlying contribution that are not applicable for all types of information. I argue that at a basic level, information could be type casted as being normal and sensitive and show why this distinction is crucial to enhance the current state of theorizing on contribution to online communities. Extant research on CMC brainstorming teams has considered failure to contribute ideas to a

brainstorming session as an act of withdrawal, namely loafing behavior (e.g., Alnuaimi et al. 2010) and has identified the anonymity prevalent in brainstorming sessions as a reason for the behavior to surface (Chidambaram and Tung 2005). Similarly, research on software project failure, has identified failure to report information relating to the project as silence behavior (Park and Keil 2009). While the former is a case of failure to share normal information (such as creative ideas to solve parking problem) due to anonymity and the freedom brainstorming sessions afford to free-ride, the latter is a case of failure to report *bad news*, for fear of the messenger getting shot. A failure to appreciate this distinction can seriously affect our ability to richly theorize about collaboration in online communities and more importantly, to correctly and comprehensively do so. An individual who might be comfortable sharing one's personal experiences with overcoming *seasonal allergies* may be averse to sharing personal experience relating to overcoming a sensitive health condition such as mental disorder. Similarly, an individual who is comfortable seeking and sharing normal health related support might be averse to both seeking and sharing sensitive support information. Thus, by considering the possible information types along with the earlier mentioned role of seeking and sharing, scholars can greatly advance our current state of theorizing on online communities.

Fluidity in Preference for Anonymity

Anonymity could be a very vital factor for the sustenance of these communities, an aspect that has not received sufficient attention in prior literature. Ma and Agarwal (2007) have advanced the notion that having one's identity successfully verified by the community members can lead to satisfaction, which can in turn encourage participation. While other researchers have cited the potential to derive benefits such as social capital (Wasko and Faraj 2005) as the driver

of contribution, I argue that it is not only social capital (Wasko and Faraj 2005) and identity verification (Ma and Agarwal 2007) that can drive intentions to collaborate, but also the freedom to do or say what one wants to without any fear of adverse consequences. Considering two levels of anonymity – *complete and none*, is essential to understand the dynamics of collaboration better. The same behavior which a scholar might classify as loafing could potentially be a silence behavior (that is, not on account of intention to free-ride), which one can discern only if one considers, not only the nature of the health condition involved, but also what the available level of anonymity was. For example, a failure to share sensitive health condition related support under anonymous condition can be argued as being loafing behavior. But the same behavior involving a sensitive health condition under identified condition could be seen as silence behavior. Being able to discern what behavior is at play is very important to be able to design appropriate interventions to drive collaboration (sharing/seeking). Further, this preference for anonymity is likely to vary over time and context. The same individuals sharing the same piece of information related to allergies could prefer anonymity on one occasion and to be identified on another (that is in different support episodes).

Thus, based on the above discussion an individual's preference for the level of anonymity (complete (high)/none (low)) could be a function of the nature of the information involved (high sensitivity/low sensitivity) and role of the user (seeker/contributor). For example, if Martha wants to seek support for a sensitive health condition, based on her privacy concern she could choose to do so anonymously or by being identified. If the need for obtaining identity-related benefits outweighs her privacy concerns, she could participate in the community with her identity revealed. Alternatively, if her privacy concerns are greater than the perceived benefits of

identity disclosure, she could choose to participate anonymously. The goal of the online community is to maximize collaboration; that is maximizing the amount of support sought and shared. As support shared and sought can be relating to common health conditions (which I term as general support) or relating to a sensitive health condition (which I term as sensitive support), it can be said that total support shared is a function of amount of general and sensitive support shared and total support sought is a function of amount of general and sensitive support sought.

Therefore, it is only when both general and sensitive support are sought and shared, the community could achieve its goal of maximizing collaboration. Based on prior research (e.g., Ma and Agarwal 2007; Preece et al. 2004; Wasko and Faraj 2005), Tables 2 and 3 present possible needs and barriers that might constrain a community member from participating in the community and how the anonymous and non-anonymous (identified) conditions might serve to help the individual to address those concerns to engage with the community.

Table 2. Support Seeker role

		System Type	
		Anonymous system	Non-anonymous system
Barrier /Need	Privacy / reputation concerns	Lowers concerns related to loss of privacy and reputation	Does not help alleviate the concern
	Need to express one's identity⁵	Does not help with addressing the need	Helps the individual to expose their identity in seeking information

⁵ Although this case is not very likely, it has been included to comprehensively account for potential variations in user motivation and preferences even in the presence of sensitive information as one's health information.

Table 3. Support Provider role

		System Type	
		Anonymous system	Non-anonymous system
Barrier /Need	Privacy / reputation concerns	Lowers concerns related to loss of Privacy and Reputation	Does not help alleviate the concern
	Need to express one's identity	Does not help with addressing the need	Provides opportunity for signaling identity

As can be seen from Tables 2 and 3 above, neither anonymous nor non-anonymous system alone can cater to the needs and concerns of community members, as members may take on different roles and may have the need to seek or share support of differing levels of sensitivity. Drawing on the discussion above, I propose “Selective Anonymity”, a middle ground between being totally anonymous and totally identified (non-anonymous), as the optimal solution to maximize user collaboration. Selective anonymity refers to the control the user (community member) possesses to selectively be anonymous or be identified (non-anonymous) as and when required in the course of seeking or sharing support. For example, when the nature of the support information is highly sensitive and deals with one’s mental health issues, the option of being anonymous may be preferred. While offering social support to another member to help them cope with their ill health, being identified might be the preferred option. These preferences might be different for different people as people may have different levels of concern about health information privacy (Anderson and Agarwal 2011). Hence, by empowering the individual to be anonymous or be identified as he or she sees fit, there is a greater likelihood of enhanced contribution as the individual can appropriately choose the level of anonymity one needs

(complete or none) depending on whether one’s need is capital (social/identity) or safe-guarding one’s privacy. Besides, even if one’s interest is not in social/identity capital, one could still selectively choose the preferred level of anonymity to avoid any harm to self and thus engage in vigilant collaboration (Jarvenpaa and Majchrzak 2010). Table 3 shows how selective anonymity condition can enable individuals to cope with the concerns they might have in participating in the OPC to seek support as compared to the anonymous or identified conditions.

Table 4. Support Seeking (Anonymous vs. Non-anonymous vs. Selective Anonymous)

	Anonymous system	Non-anonymous system	Selective-anonymous system
Privacy/reputation concerns	Lowers concerns related to loss of privacy and reputation	-	<i>Lowers concerns related to loss of privacy and reputation</i>
Need to express one’s identity	-	Provides opportunity for signaling identity	<i>Provides opportunity for signaling identity</i>

As shown in Table 4, the selective anonymity condition can help support seekers to cope with both—the need to express identity (for social/identity capital) and the need to avert threat to privacy or reputation, which purely anonymous or identified systems cannot afford. Thus, the individual who wants to seek health related support from the community can choose the level of anonymity that “fits” with one’s preference (a function of type of health condition involved and one’s privacy related concerns). It is likely that an individual will seek more support (comprised of both neutral and sensitive support requests) under the selective anonymity condition as compared to the anonymous or identified condition alone. Hence, I hypothesize:

H1: Amount of support sought by a member will be greater under the selective anonymity condition compared to the non-anonymous condition.

H2: Amount of support sought by a member will be greater under the selective anonymity condition compared to the anonymous condition.

Table 5 shows how selective anonymity can help individuals to cope with the concerns they might have in participating in the OPC to share support as compared to anonymous and identified conditions.

Table 5. Support Sharing (Anonymous vs. Non-anonymous vs. Selective Anonymous)

Barrier/Need	Anonymous system	Non-anonymous system	Selective-anonymous system
Need to express one's identity	-	Provides opportunity for signaling identity	<i>Provides opportunity for signaling identity</i>
Privacy/reputation concerns	Lowers concerns related to loss of privacy and reputation	-	<i>Lowers concerns related to loss of privacy and reputation</i>

As shown in Table 5, the selective anonymity condition can enable the contributors of support to cope with both, the need to express identity (for social/identity capital) and the need to avert threat to privacy or reputation, which purely anonymous or identified systems cannot provide. Thus, the individual who wants to share support with a requester can choose the level of anonymity that “fits” with one’s preference (a function of type of health condition involved and one’s privacy related concerns). It is likely that an individual will share more support (comprised of both neutral and sensitive support) under the selective anonymity condition as compared to the anonymous or identified condition alone. Hence, I hypothesize:

H3: Amount of support shared by a member will be greater under the selective anonymity condition compared to the non-anonymous condition.

H4: Amount of support shared by a member will be greater under the selective anonymity condition compared to the anonymous conditions.

METHODOLOGY

Sample and Data Collection

To test the proposed hypothesis, I followed the methodology adopted by Anderson and Agarwal (2011) in studying individual's willingness to share health information with various stakeholders. A *scenario-based repeated-measures quasi experiment* was employed wherein participants were presented with hypothetical scenarios (Appendix A) and asked for their response – that of, willingness to seek and share health information under various system types. The sample was drawn from the members of an online consumer panel. A total of 462 participants based in US completed the survey of which nearly 53 percent were female. Details on the sample demographics are available in Appendix B.

Operationalization of Variables

The measures used in the study were adapted from prior studies and contextualized to the study's context. Intention (willingness) to seek and intention (willingness) to share were adapted from Anderson and Agarwal (2011). The anchor points were unlikely/likely, not probable/probable and unwilling/willing. Participants were specifically asked to indicate their willingness to seek and share general and sensitive health information. This is similar to the methodology adopted by Anderson and Agarwal (2011) wherein respondents were asked for their willingness to share general, mental and genetic health information. In assessing the respondent's willingness to seek and share general and sensitive health information, I presented

examples of ailments that characterize general and sensitive health information. The list of diseases presented as example was arrived at in a step by step fashion.

In the first step, academic literature was consulted to identify diseases that could be classified as being low and high in terms of their associated sensitivity. The recent work by Caine and Hanania (2013) which showed that patients desire to have control over their health information varied as a function of the how sensitive the health information is, was used as the basis in preparing the list of illustrative disease names. Further, experts in the healthcare domain were contacted to build a list of diseases representative of high, medium and low sensitivity. This included physicians and healthcare scholars at the nation's premier institutions. Also, the comments and inputs of a researcher at one of the leading OPCs were solicited to further refine the list of diseases. A total of 22 health issue (disease) names were identified to represent low, medium and high sensitive diseases.

In the next stage, two pilot studies (n=102 and n=100) were conducted among members of an online consumer panel. Apart from using the pilot studies to validate the vignettes and get feedback, I also used it to get participant's perception of the sensitivity of the list of health issues identified from the previous step. The participants rated each of the 22 health issues in terms of how sensitive they thought each was on a scale of 1 to 7. Following this an analysis of the mean sensitivity scores was done. By comparing the mean sensitivity scores along with the expert's recommendations, *seasonal allergy, dental issues, pneumonia and ophthalmology (eye related) issues* were chosen as representative of general health issues. *Sexual health (HIV/STD), reproductive health (infertility/abortion), mental health (depression/anxiety) and cancer*

(*prostate/ovarian*) were chosen as representative of Sensitive health issues. More details on the pilot study are available in Appendix C.

Prior to launch of the actual survey, a third pilot study was conducted among student sample (n=65) using a within subjects design and the two health categories (general/sensitive) identified earlier. To give the respondent an idea of the type of health issues being referred to as *general* and *sensitive*, a list of the sample health issues (from above) was provided. By having to respond to only two health issue types – general and sensitive, there is a far lesser burden on the respondent compared to indicating willingness to seek and share under each of the system types for the 22 health issues. This approach is also in line with Anderson and Agarwal's research wherein they employed *general, mental and genetic* health information categories. Attention was paid to open ended comments to identify any issues with the survey design. No major issues were identified. Participant comments about the system type showed that they were able to discriminate well among the three system types.

Following this, I proceeded to launch the actual study. As already stated the sample was drawn from the members of an online consumer panel based in the US (n=462). I opted for a within-subjects design instead of a between-subjects design, in the lines of Anderson and Agarwal (2011), for four reasons. First, a within-subjects design allows control for individual differences and thus reduces unsystematic variability in the design and in turn provides greater power to detect the underlying effects (Grabe and Westley 2003). Second, the key driver of this research is in understanding how an individual's willingness to seek and share health support is likely to vary across differing system types and in particular under selective anonymous condition compared to anonymous and non-anonymous conditions. Being so, eliciting the same

individual's response to the different system types would be more appropriate to answer the research question compared to a between subjects design. Third, since the key contribution of this research would be the conceptualization and testing of the new system type, I was interested in testing the efficacy of selective anonymous system on influencing seeking and sharing *even after the respondent has duly considered* the other two systems (anonymous and non-anonymous). That is, I wanted the participant to indicate their willingness to seek and share under selective anonymous condition *after they have had sufficient opportunity to consider the benefits and disadvantages of the other two conditions*. That way, any bias in the response purely on account of the *novelty* of the selective anonymous system could be minimized. To achieve this, I abstracted the *selective anonymous* system from the respondent at the beginning of the survey. Participants were provided with contextual information about OPCs in general and were shown vignettes of only anonymous and non-anonymous system. Subsequently they were assigned to various scenarios (seeking/sharing support for general/sensitive health issues) wherein they had to indicate their willingness to seek (share) health support under the anonymous and non-anonymous conditions for general and sensitive health information. At the end of this exercise, participants were introduced to the selective anonymous system. This method also had the advantage that there is far lesser cognitive burden on the respondent, in having to assimilate details about all the three system types right at the start of the survey. Since it is not possible to accomplish this in a between subjects design, the within subjects design was preferred. Fourth, although not the key focus of the present study, a repeated measure design would also help to build on Anderson and Agarwal's (2011) research by also considering the

moderating influence of the system type on the effect of the privacy calculus variables (privacy and trust) on health information seeking and sharing behavior.

RESULTS

Following Anderson and Agarwal (2011) I used a repeated-measures ANCOVA analysis to examine the influence of system type on willingness to seek and share health information. Thus, using this analysis I examine an individual's within-subject willingness to seek and share health information under each of the three system types. This is consistent with Anderson and Agarwal's (2011) research which examined individual willingness to share health information with various stakeholders for different purposes. A Bonferroni test was used to compare the means across groups (system type conditions). Following Anderson and Agarwal (2011), I included age, gender, race, income, education, health status, privacy concerns, trust, past privacy violations, and prior OPC usage experience as covariates in the model.

The Mauchly's test was used to assess violation of sphericity (Field 2000). As there was a violation of sphericity, I used the Greenhouse and Geisser (1959) estimates for obtaining the correction factor to assess the F-ratio. The results are reported in Tables 6 and 7. As seen from Table 6, the system type had a significant influence on Willingness to Seek health information ($F_{1.585, 451} = 8.33; p < .001$).

Table.6 Repeated-Measures ANCOVA Table for Willingness to Seek Support

Source of variance	Degrees of freedom ⁺	Mean Square	F-Statistic	P-Value
<i>Within subject factors</i>				
System type	1.585	16.99	8.33	.001
Error(type)	715.03	2.04		
<i>Covariates</i>				
Age	1	5.12	1.62	.204
Gender	1	3.82	1.21	.272
Race	1	3.79	1.20	.274
Income	1	14.24	4.51	.034
Education	1	13.96	4.42	.036
Prior OPC Use	1	21.48	6.80	.009
Health Status	1	.842	.267	.606
Trust	1	767.03	242.74	<.001
Privacy Concern	1	.404	.128	.721
Past Privacy Violation	1	5.06	1.60	.206
Error	451	3.16		

Note:

⁺ - Greenhouse and Geisser (1959) estimate was used to make correction as the F-Statistic violated the sphericity assumption ($p < .001$) for the within subjects factor

Table 7 shows the results of the pairwise comparison of mean effect of system type on willingness to seek health information. Hypothesis 1 predicted that amount of support sought by a member will be greater under the selective anonymous condition compared to the non-anonymous condition. Results show that selective anonymous systems are better than identity revealing systems in influencing willingness to seek health information (Mean difference = - 2.35, $p < .001$). Thus hypothesis H1 is supported. Hypothesis H2 predicted that amount of support sought by a member will be greater under the selective anonymous condition compared to the anonymous condition. Results show that there was no significant difference between selective anonymous systems and anonymous systems (Mean difference = -.056; $p = n.s.$) in

terms of their effect on influencing willingness to seek health information. Thus hypothesis H2 is not supported.

Table.7 Pairwise Comparison of Means for Willingness to Seek Support

System 1	System 2	Mean difference	S.E.	Significance
Non-Anonymous	Selective anonymous	-2.35	.091	<.001
Anonymous	Selective anonymous	-.056	.063	n.s.
Non-Anonymous	Anonymous	-2.29	.101	<.001

As seen from table 8, the system type had a significant influence on Willingness to Share support ($F_{1,742, 451} = 3.91$; $p < .05$).

Table.8 Repeated-Measures ANCOVA Table for Willingness to Share Support

Source of variance	Degrees of freedom ⁺	Mean Square	F-Statistic	P-Value
<i>Within subject factors</i>				
System type	1.742	6.192	3.91	.026
Error(type)	785.76	1.584		
<i>Covariates</i>				
Age	1	16.96	3.832	.051
Gender	1	5.59	1.26	.262
Race	1	10.27	2.32	.130
Income	1	50.141	11.33	.001
Education	1	11.06	2.499	.115
Prior OPC Use	1	24.13	5.45	.020
Overall Health	1	11.79	2.66	.103
Trust	1	803.82	181.59	<.001
Privacy Concern	1	2.803	.633	.427
Past Privacy Violation	1	1.814	.410	.522
Error	451	4.426		

Note:

⁺ - Greenhouse and Geisser (1959) estimate was used to make correction as the F-Statistic violated the sphericity assumption ($p < .001$) for the within subjects factor

Pairwise comparison of the influence of the system type on individual's willingness to share information is shown in Table. 9. Hypothesis H3 predicted that amount of support shared by a member will be greater under the selective anonymous condition compared to the non-anonymous condition. Results show that selective anonymous systems are better than identity revealing systems in influencing willingness to seek health information (Mean difference = -1.76, $p < .01$). Thus Hypothesis 3 is supported. Hypothesis H4 predicted that amount of support shared by a member will be greater under the selective anonymous condition compared to the anonymous condition. Results show that there was no significant difference between selective anonymous systems and anonymous systems (Mean difference = .017, $p = n.s.$) in terms of their effect on influencing willingness to seek health information. Thus hypothesis H4 is not supported.

Table.9 Pairwise Comparison of Means for Willingness to Share Support

System 1	System 2	Mean difference	S.E.	Significance
Non-Anonymous	Selective anonymous	-1.76	.080	<.001
Anonymous	Selective anonymous	.017	.062	n.s.
Non-Anonymous	Anonymous	-1.78	.088	<.001

Further, the results in Table.7 and 9 show that anonymous systems are better than non-anonymous systems in influencing willingness to seek health information (Mean difference = -2.29, $p < .001$) and in influencing willingness to share health information (Mean difference = -1.78, $p < .001$).

DISCUSSION

The purpose of this research was to examine how online health community system design might influence member support seeking and sharing behavior. Specifically, in light of recent call in literature to examine whether these systems must be anonymous or non-anonymous and increasing evidence suggesting the need for user control in healthcare context (e.g., Anderson and Agarwal 2011; Caine and Hanania 2013), this research examined the downstream impacts of affording user control over their identity on support seeking and sharing behavior. Drawing on the social loafing and silence streams of literature this research theorized that a system that allows for *user control* over how they manage their identity would be a better design compared to either a completely anonymous or non-anonymous system. Results show that affording user control could enhance both health information seeking and sharing compared to a non-anonymous system. While user control system did not have a better influence over anonymous systems in influencing seeking and sharing behavior, the fact that the effect of these systems was comparable (just as good) to the effect of anonymous systems, supports the case that OPC administrators can safely consider opting for a *user control* centric design without concerns about any significant drop in member participation. However, if designers had a choice only between designing an anonymous vs non-anonymous system, the research findings suggest, anonymous system design would be an ideal choice to consider.

Contributions

This research makes several important contributions to the literature. First, this research advances IS theory on online participation by integrating two well established literature streams, silence and loafing, which to the best of my knowledge, despite their conceptual

complementarity, have continued to be studied in silos. Second, by theorizing that loafing and silence could be complementary behaviors this research contributes to both the loafing and silence literature streams as well. Researchers in social psychology, who study loafing behavior in groups, may want to consider whether the behavior they see as loafing could actually be silence behavior. Similarly, researchers in organizational behavior who study employee silence behavior and ways to overcome it should consider the possibility that the underlying behavior could actually be *loafing* or *freeriding* such as failing to contribute to feedback forums. By doing so, appropriate interventions can be designed to tackle the root cause and thus encourage enhanced participation and contribution. Third, by advancing theory driven arguments relating to both seeking and sharing behavior in online patient communities, this research also potentially contributes to the literature on online communities in general and online patient communities in particular. Finally, by conceptualizing and theorizing lurking in terms of silence and loafing behavior this research contributes to the stream of literature on lurking as well. By showing that designing interventions that focus on just one of the two phenomena (loafing/silence) could result in a paradoxical situation (whereby creating favorable conditions to *seek* sensitive information, could in fact decrease the willingness to *share* normal information and vice-versa), this research has important consequences for system design and public policy as well. The findings of this research are also relevant to other settings where maximizing user collaboration is important. For example, research on brainstorming has employed anonymity as a way of facilitating contributions that are unhindered by evaluation apprehensions. However, it overlooks the possibility that members may also have a need to express their identity, particularly when a high quality idea is being shared. Thus, provisions of selective anonymity in systems that support

brainstorming might facilitate maximizing idea generation and curtail social loafing behavior which prior research has observed in such settings (e.g., Chidambaram and Tung 2005). Thus the research findings also have implications for the rich stream of research on electronic brainstorming.

Limitations and Future Research

Like all research, this research also has some limitations. First, the study was not conducted among actual members of an *online health community* but among members of an *online consumer panel*. While the ideal research design would be to examine the influence of each of these system types on actual behavior, considering the sensitivity of health information to individuals and the vulnerabilities that it can expose them to, a design employing fictitious scenarios seemed appropriate. However, future research could consider research designs wherein these system types can be studied in a better fashion with actual users of online health communities. Second, this study employed *vignettes* of the various system types. Being so, it is possible that the distinction among the three system types was not as salient to the respondents as it could have been had they had a chance to really use the systems. Future research should consider designing actual systems that respondents could use. Third, seeking and sharing behavior was measured in terms of participant's self-reported scores. The better alternative would be to observe actual behavior in terms of number of questions asked (help sought) and answered (help shared). This could be achieved by assigning participants a pseudonym such as those used in brainstorming research to tie back survey responses to actual idea contribution. A simpler alternative would be to just measure the number of unique message threads and the number of responses within each thread in health communities that are anonymous and those that

are identity revealing. Fourth, a repeated measures design could potentially give rise to carry-over effects. Since it was very important that individuals clearly discriminate the three system types before responding to the questions that ensue, I decided to introduce only two system types initially (anonymous and non-anonymous systems). Since these are also the most common types of system design available online, it seemed appropriate that user's responses to their likely behavior under these two settings are solicited prior to eliciting their responses to a new system. Since this is achievable only via a within subjects design, I used it instead of a between subjects design. Further, there is prior research to support usage of repeated measures in the current context. Recently Anderson and Agarwal (2011) conducted a repeated measures study in the context of health information sharing under 27 different scenarios. Future research should test the findings of this research using a between subjects design as well.

Practical Implications

This research has several practical implications for both administrators of OPC as well as for public policy makers. Given the emphasis from federal government on empowering consumers and giving them control over their health information through initiatives such as Blue Button, this research suggests that even simple interventions such as minor system design interventions can serve to empower users over how their identity is associated with their postings. Also, the findings of this research suggest that OPC administrators can safely consider opting to a *user preference* mode if they are currently offering only an anonymous or a non-anonymous OPC. While user-preference OPC systems have the inherent advantage of the user taking responsibility for how their identity is managed, it is possible for individuals to accidentally post sensitive health information with their identity revealed. Thus, public policy

makers should consider requiring all OPC systems to introduce a two stage process, whereby in the first stage the member is shown how their posting will be shown in the OPC when confirmed by the user. Only upon confirmation by the member should the system proceed to publish the member's posting. This can serve to minimize the vulnerabilities that OPC system can expose members to. Finally, while anonymous OPCs and user-preference (selective-anonymous) OPCs allow users to remain anonymous, an important question is whether users perceive the anonymity as really existent. With sophisticated software to track individual location, IP address and such, it remains to be seen whether users believe the option to be *anonymous* as really achieving the purpose. Administrators of OPCs could consider employing *trust assuring arguments* and *anonymity seals* that attest to the authenticity of the anonymity afforded by the system. Further, federal government should consider framing policies that bring OPCs under strict guidelines over how the collected health information is handled. For example, OPCs like PatientLikeMe share the postings with affiliate companies such as drug manufacturers which can be a cause of concern to members. With a strict public policy in place and measures to enforce it, members may feel more comfortable in using OPCs even if the data they share is in turn shared with firms that are engaged in medical research. Finally, the selective anonymous design intervention can have beneficial outcomes in several contexts outside healthcare as well. For example, user reviews are an important part of a consumer's purchase decision making process (Gu et al. 2012). Being so, many firms attempt to encourage their users to rate their experience and/or rate their product and service. For example, companies such as Amazon regularly mail consumers with invitation to rate products they had earlier purchased. While privacy concerns associated with one's identity being revealed along with one's postings (ratings) could undermine member

willingness to accede to the request, the availability of an option to choose to be either anonymous or non-anonymous could potentially serve to enhance member response to such requests. Also, in the context of brainstorming where research has shown loafing behavior to be a major concern (e.g., Srinivasan et al. 2010), brainstorming system developers could consider making available the option to be *selectively anonymous*. Thus, participants could express unpopular opinion (such as a dissenting note) anonymously and new product ideas with their identity which can in turn help them get recognition. This could bring down the level of withdrawal behavior observed in such settings to some extent.

CONCLUSION

The purpose of this research was to understand how design of the online patient community system might affect usage of these systems. Following recent research findings and government mandate to accord users control, this research specifically examined the effect of OPC systems that let users to control their identity on the downstream seeking and sharing of support. Research findings suggest that OPC systems that afford user control are better than non-anonymous systems to enhance both seeking and sharing of health related support. However, they were not any better than anonymous systems in influencing seeking and sharing intentions. In light of the recent research findings and governmental mandate to accord user control, the research findings suggest that OPC communities can opt to use a user-control design without concerns about a significant adverse effect on member participation.

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APPENDIX A SURVEY VIGNETTE

What is an Online Health Community?

A type of internet based social network that allows you to seek and share health related support (information and social support) Examples: WebMD Health Community, weightwatchers online

Possible to find members with “personal health experience” of even very rare diseases. Members “post” their questions and concerns to which others can respond to



Image Source: <http://www.patientslikeme.com/>

<< Type your question here >>

40/150

ASK QUESTION

- Ask a specific question
- Be brief and to the point
- Stay focused to a single health issue

Image Source: Adapted from <https://www.healthtap.com/>

Using Online Health Communities

Using an Online Health Community involves creating a user account and an associated user profile

Sign up

Email **EMAIL ADDRESS AS USERNAME**

Already a member? [Log in »](#)

By signing up, you agree to our [Terms of Use](#) and [Privacy Policy](#), and you confirm that you're 16 years old or over.

WHAT IS YOUR NAME?


ARE YOU

WHAT'S YOUR DATE OF BIRTH?

WHERE DO YOU LIVE?

TAKE A PHOTO

Put a beautiful face to that name.



Enter names of health topics you're interested in, conditions you have, medications you take, symptoms you experience, or procedures you've had.

A)

B)

C)

Image Source: Adapted from <https://www.healthtap.com/>

Information posted by the members in the community (such as, biographical information, condition/disease information, treatment information, symptoms, interactions in the community) are stored in the Community's database

Feed
Ask Doctors
Tips
Your Activity
Your Doctors
Find Doctors
Conditions
Symptoms
AppRx NEW
Medications
Procedures
Wellness
Invite Friends

20%
COMPLETE YOUR PROFILE FOR BETTER ANSWERS

ABOUT ME

FIRST NAME **LAST NAME**
Anonymous Member

SEX
 Male Female

BORN ON
January 1 1975

LOCATION
- Select - ZIP code

PROFILE PHOTO
Current image:




ABOUT ME
CONTACT INFORMATION
INSURANCE INFORMATION
MEDICATIONS
ALLERGIES
SYMPTOMS & CONDITIONS
PROCEDURES
IMMUNIZATIONS
PHARMACY INFORMATION

Many health communities share the collected information in individual and aggregate format, with their partners and other third parties for use in market research and scientific research

Image Source: <https://www.healthtap.com/>

Online health Communities can be of TWO (2) types. A brief note on each type is available in the following pages

Type 1: ANONYMOUS Online Health Community

	How much does it cost to have a flu shot?
Guest 1	
	Depends where you go to ... any case don't worry, most insurance programs will cover the expense
Guest 2	
	@ Guest 2: Thank you !! That is such a big relief I am not in a position to spend any more \$\$\$\$ in the doctor's office
Guest 3	

Only the information posted by a member (request for help or a reply to a request) is displayed without any information about who made the posting

Members cannot reveal one's identity (be non-anonymous) even if one wants to, say when one wants recognition for taking the time to help someone

Type 2: IDENTITY-REVEALING Online Health Community

You are logged in as *Bob Mani*

Message:

If you tell me where you are located, I can suggest you the closest available center where you can get a free flu shot.

Good Luck and Stay safe!

Note: This message will appear with your "UserName" and all details associated with it.

SUBMIT

The member's identity (e.g., user profile information) is revealed along with the posting

Members cannot conceal their identity (be anonymous) even if one wants to, say when the user does not want to be identified with one's postings

SEEKING (ASKING) HELP

The following questions address your willingness to SEEK (ASK) health information from other community members. For each question, assume you have a real need to find assistance. As in a real world scenario consider the costs and benefits involved with your action as you respond.

Scenario: SEEKING (ASKING) HELP FOR GENERAL HEALTH ISSUES

For the following questions, please think of General health issues as potentially including such health issues as seasonal allergy, dental issues, pneumonia, ophthalmology (eye related) issues

Assuming you have a real need to find assistance specify the extent to which you would be willing to SEEK help for General health issues using

ANONYMOUS ONLINE HEALTH COMMUNITY

	1	2	3	4	5	6	7
Unlikely:Likely	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Probably Not:Probably	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Unwilling:Willing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

IDENTITY-REVEALING ONLINE HEALTH COMMUNITY

	1	2	3	4	5	6	7
Unlikely:Likely	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Probably Not:Probably	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Unwilling:Willing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Scenario: SEEKING (ASKING) HELP FOR SENSITIVE HEALTH ISSUES

For the following questions, please think of Sensitive health issues as potentially including such health issues as sexual health (HIV/STD), reproductive health (infertility/abortion) mental health (depression/anxiety), and cancer (prostate/ovarian)

Assuming you have a real need to find assistance specify the extent to which you would be willing to SEEK help for Sensitive health issues using

ANONYMOUS ONLINE HEALTH COMMUNITY

	1	2	3	4	5	6	7
Unlikely:Likely	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Probably Not:Probably	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Unwilling:Willing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

IDENTITY-REVEALING ONLINE HEALTH COMMUNITY

	1	2	3	4	5	6	7
Unlikely:Likely	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Probably Not:Probably	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Unwilling:Willing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

SHARING (GIVING) HELP

The following questions address your willingness to SHARE (GIVE) health information to other community members under different conditions. For each question, assume you have the relevant personal health experience / required knowledge to offer help. As in a real world scenario consider the costs and benefits involved with your action as you respond.

Scenario: SHARING (GIVING) HELP FOR GENERAL HEALTH ISSUES

Assuming you have the relevant personal health experience / knowledge specify the extent to which you would be willing to SHARE help for General health issues using

ANONYMOUS ONLINE HEALTH COMMUNITY

	1	2	3	4	5	6	7
Unlikely:Likely	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Probably Not:Probably	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Unwilling:Willing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

IDENTITY-REVEALING ONLINE HEALTH COMMUNITY

	1	2	3	4	5	6	7
Unlikely:Likely	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Probably Not:Probably	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Unwilling:Willing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Scenario: SHARING (GIVING) HELP FOR SENSITIVE HEALTH ISSUES

Assuming you have the relevant personal health experience / knowledge specify the extent to which you would be willing to SHARE help for Sensitive health issues using

ANONYMOUS ONLINE HEALTH COMMUNITY

	1	2	3	4	5	6	7
Unlikely:Likely	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Probably Not:Probably	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Unwilling:Willing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

IDENTITY-REVEALING ONLINE HEALTH COMMUNITY

	1	2	3	4	5	6	7
Unlikely:Likely	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Probably Not:Probably	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Unwilling:Willing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

We have designed a new type of Online Health Community and would like to get your opinion about the new design. You will read some details about the new system (community) in the following page

Type 3: USER PREFERENCE Online Health Community

Message:

If you tell me where you are located, I can suggest you the closest available center where you can get a free flu shot.
Good Luck and Stay safe!

How do you want to make this posting as?

With my User-Name

Anonymously

Governed by user's choice

Users can be ANONYMOUS [OR] IDENTIFIED as and when they prefer

User has full control ("freedom of choice") in deciding whether or not to disclose identity in seeking and sharing health information

For example, the user could ask questions anonymously and answer other's questions with identity depending on whether one wants other to know about their postings or how comfortable the user is in his/her identity being associated with the information one seeks/shares

The following questions address your willingness to SEEK (ASK) and SHARE (GIVE) health information using a USER-PREFERENCE health community As in a real world scenario consider the costs and benefits involved with your action as you respond.

Scenario: SEEKING HEALTH INFORMATION USING USER-PREFERENCE COMMUNITIES

In the following questions...

GENERAL HEALTH ISSUES refers to health issues such as

seasonal allergy, dental issues, pneumonia, ophthalmology (eye-related) issues

SENSITIVE HEALTH ISSUES refers to health issues such as

sexual health concerns (HIV/STD), reproductive health queries (infertility/abortion), mental health concerns (depression/anxiety), cancer (prostate/ovarian)

Assuming you have a real need to find assistance...

Specify the extent to which you would be willing to SEEK help for GENERAL HEALTH ISSUES using a

User-Preference Community

	1	2	3	4	5	6	7
Unlikely:Likely	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Probably Not:Probably	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Unwilling:Willing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Specify the extent to which you would be willing to SEEK help for SENSITIVE HEALTH ISSUES using a

User-Preference Community

	1	2	3	4	5	6	7
Unlikely:Likely	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Probably Not:Probably	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Unwilling:Willing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Scenario: SHARING HEALTH INFORMATION USING USER-PREFERENCE COMMUNITIES

In the following questions...

GENERAL HEALTH ISSUES refers to health issues such as

seasonal allergy, dental issues, pneumonia, ophthalmology (eye-related) issues

SENSITIVE HEALTH ISSUES refers to health issues such as

sexual health concerns (HIV/STD), reproductive health queries (infertility/abortion), mental health concerns (depression/anxiety), cancer (prostate/ovarian)

Assuming you have the personal health experience/required knowledge,

Specify the extent to which you would be willing to SHARE help for GENERAL HEALTH ISSUES using a

User-Preference Community

	1	2	3	4	5	6	7
Unlikely:Likely	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Probably Not:Probably	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Unwilling:Willing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Specify the extent to which you would be willing to SHARE help for SENSITIVE HEALTH ISSUES using a

User-Preference Community

	1	2	3	4	5	6	7
Unlikely:Likely	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Probably Not:Probably	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Unwilling:Willing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

APPENDIX B SAMPLE DEMOGRAPHICS

Table B1. Demographics for sample and U.S. Population

Demographic Characteristic		Sample (%)	U.S. Population (%)
Age	18-24	23.4	Approx. 11
	25-34	38.7	17.5
	35-44	14.5	18.9
	45-54	12.3	18.8
	55-64	7.6	13.7
	65-74	3.2	8.2
	75 and over	2	8.0
Education	8th grade or less	.2	6.5
	Some high school, no diploma	1.1	9.4
	High School Graduate or equivalent	12.8	30
	Some college but no degree	29.2	19.5
	Associate's degree	8.9	7.4
	Bachelor's degree	35.5	17.1
	Master's degree and above	12.3	9.9
Income	Less than \$ 10, 999	7.4	8
	\$10,000 to \$14,999	7.8	5.9
	\$15,000 to \$24,999	12.3	11.4
	\$25,000 to \$34,999	13.2	11.2
	\$35,000 to \$49,999	19.9	14.8
	\$50,000 to \$74,999	20.1	19.0
	\$75,000 to \$99,999	11	11.8
	\$100,000 and above	8.3	17.9
Gender	Female	52.8	51
		8.7	14.8
Race	White	77.1	73.9
	African American	6.1	12.4
	Asian	6.5	4
Hispanic		8.7	14.8

Source: U.S. Population (%) scores were drawn from Anderson and Agarwal (2011)

REFERENCE

- Anderson, C. L., and Agarwal, R. 2011. "The Digitization of Healthcare: Boundary Risks, Emotion, and Consumer Willingness to Disclose Personal Health Information," *Information Systems Research* (22:3), September, pp. 469–490

APPENDIX C NOTE ON PILOT STUDIES

Pilot studies 1 (n=102) and 2 (n=100) were conducted in a between-subjects fashion. A note on the observed results is made here.

Participants were randomly assigned to one of 3 system types – anonymous, non-anonymous (identified) and selective-anonymous (user preference) condition and one of two conditions – seeking, sharing. Participants were asked to indicate their willingness to seek (share) health support for each of the 22 health issues. Analysis of the mean score of responses from pilot study-1 revealed that *selective anonymous condition had the highest mean for seeking* (selective anonymous-5.37, anonymous-4.9, non-anonymous – 4.63) *and also for sharing condition* (selective anonymous-5.41, anonymous-5.33, non-anonymous – 5.34). Results from the second pilot study also showed that selective anonymous condition had the highest mean for seeking (selective anonymous-4.72, anonymous-4.62, non-anonymous – 4.46) and also for sharing condition (selective anonymous-4.87, anonymous-4.44, non-anonymous – 4.45).

APPENDIX D RESEARCH COMPLIANCE PROTOCOL LETTER

June 14, 2013

MEMORANDUM

TO: S. Sankara Subramanian
Fred Davis

FROM: Ro Windwalker
IRB Coordinator

RE: New Protocol Approval

IRB Protocol #: 13-06-742

Protocol Title: *Online Health Communities*

Review Type: EXEMPT EXPEDITED FULL IRB

Approved Project Period: Start Date: 06/14/2013 Expiration Date: 06/13/2014

Your protocol has been approved by the IRB. Protocols are approved for a maximum period of one year. If you wish to continue the project past the approved project period (see above), you must submit a request, using the form *Continuing Review for IRB Approved Projects*, prior to the expiration date. This form is available from the IRB Coordinator or on the Research Compliance website (<http://vpred.uark.edu/210.php>). As a courtesy, you will be sent a reminder two months in advance of that date. However, failure to receive a reminder does not negate your obligation to make the request in sufficient time for review and approval. Federal regulations prohibit retroactive approval of continuation. Failure to receive approval to continue the project prior to the expiration date will result in Termination of the protocol approval. The IRB Coordinator can give you guidance on submission times.

This protocol has been approved for 2,500 participants. If you wish to make *any* modifications in the approved protocol, including enrolling more than this number, you must seek approval *prior to* implementing those changes. All modifications should be requested in writing (email is acceptable) and must provide sufficient detail to assess the impact of the change.

If you have questions or need any assistance from the IRB, please contact me at 210 Administration Building, 5-2208, or irb@uark.edu.

CONCLUSION

The following sections outline the summary of research finding of each essay, the theoretical and practical contributions and directions for future research.

SUMMARY OF FINDINGS

Essay-1 examined factors that underlie consumer adoption of mobile health applications (health apps). By building on two well-established theories from the health sciences and the information systems disciplines, the Health Belief Model (HBM) and the Technology Acceptance Model (TAM), and by drawing relevant constructs from recent research on consumer acceptance of technology (UTAUT2), this research proposed a model to explain consumer adoption of health apps. Results of the study show that *perceived usefulness*, *hedonic motivation*, *facilitating condition* and *social influence* as key predictors of *intention to adopt* mobile health applications. Also, self-efficacy (of managing health) was found to influence perceptions of ease of use of the health application. Interestingly, *health motivation* of an individual had a significant influence on perceptions of usefulness of the application whereas, *health threat* did not. The proposed model could explain about 62 percent of variation in the intention to adopt the health application. This research extends our knowledge of consumer acceptance of technologies to a consumer health IT context.

Essay-2 examined whether interventions could be used to drive consumer adoption of health apps. In particular, building on the findings from Essay-1, this essay specifically examined whether messages that highlight the health benefits of using the health app could influence perceptions of usefulness of the health app and in turn adoption intention. Additionally, it also considered the role of word of mouth information (user reviews) in influencing the efficacy of

such interventions. By building on the message framing, word of mouth, processing fluency and trust streams of literature this research this research proposed and tested a model to explain the interaction between message framing interventions and word of mouth information in influencing consumer adoption of health apps. Results show that messages that highlight the benefit of using the health app could influence perceptions of usefulness. Further, when the user reviews were positive, the congruence in the two message sources positively influenced trust and perceptions of usefulness, which in turn influenced adoption intentions.

Essay 3 focused on a particular type of HIT, online patient community (OPC) and examined whether affording control to users in deciding whether to be anonymous or non-anonymous could lead to enhanced usage of the system. To answer this question this study employed prior research findings from the social loafing and employee silence literature streams. Research findings show that OPC systems that afford user control were better than non-anonymous systems in influencing both seeking and sharing of support. However, interestingly, they were not any better than anonymous OPC systems in influencing seeking and sharing of support.

CONTRIBUTIONS

Together these three studies make several contributions to research and practice. The contribution of each of the essays is outlined in the following paragraphs.

Essay-1 makes several key contributions to the literature. By integrating two well established theory streams, i.e., HBM and TAM, this research advances our knowledge of factors that drive consumer adoption of health IT. Also, by integrating the HBM with TAM using theory-driven arguments, this research accounts for the intervening mechanism through which the health belief variables affect one's healthful behavior. Seen another way, this research

proposes health related antecedents to the TAM constructs. In so doing, this research also addresses the call in the literature to better understand the issues around user acceptance of HIT systems. By adapting the UTAUT2 constructs to a consumer health IT setting, this research is also one of the first IS research studies to integrate UTAUT2 with the HBM and also UTAUT2 with the TAM. In doing so, this research also has extended the application of UTAUT2 to a consumer health context from a consumer IT context. Finally, this is one of the first IS research studies to identify the factors underlying consumer adoption of HIT systems, specifically health apps. Thus it advances our current state of knowledge of user adoption of IT to a healthcare context.

The findings of this study have implications for software firms, hospitals and government agencies engaged in the development of health and wellness apps. First, given the thousands of health apps in the market, a key question that faces developers of health apps is *how to get consumers to try my app*. This is because the first step to engaging the customer and sustaining them over period is actually to make the customer try the product/service in the first place. This research presents various implications that are valuable to practitioners. First, the research findings suggest that interventions that seek to enhance one's health motivation – such as those that highlight the benefits of staying healthy or tracking calorie intake using the app are more likely to be effective in influencing perceptions of usefulness of the health app. Thus, while using graphic images on cigarette pack may be an effective way of dissuading consumers from smoking, in the context of health apps it appears, such fear-inducing strategies may not be as effective. This means, health app advertisements could be tuned to being more promotion-focused. Given the significant amount of money that firms are spending on online advertisements, knowledge of what kind of message in the advertisement is likely to yield the

desired outcome is valuable. Second, this research shows that social influence is an important predictor of adoption intentions. So, health app firms could attempt to leverage social networks, such as Facebook, Twitter to induce app adoption across the network. For example, early adopters of the app *liking* the app on their Facebook page or *tweeting* about the benefits of using the app could serve to more strongly appeal to the attention of the members in the focal member's social circle.

Essay-2 contributes to IS research in four ways. First, it integrates the message framing and word of mouth literature streams, which despite their similarity have continued to be studied in silos. Second, IS research to date has not focused on the processing fluency theory, which the marketing literature shows to be having powerful influences over consumer attitudes and behavior. By integrating the processing fluency theory into the IS literature, this research advances our understanding about how messages are processed and what the consequences of such processing are on downstream consequences such as adoption. Third, by focusing on word of mouth related to healthcare, it also fills the gap in the WOM literature involving high involvement products. Finally, given that there is limited research on the role of interventions in driving adoption and usage, this research contributes to the body of research on interventions driving IT adoption and usage also.

In response to the growing emphasis on health and wellness, a lot of firms are in the business of developing health apps that can assist consumers to self-manage their health and wellness. However, the adoption of health apps has been sluggish. The findings of this research suggest that health app firms could potentially consider message framing strategies that highlight the benefits of the app as a way to drive health app adoption. In doing so, this research also

highlights the importance of paying attention to the role of user reviews, which are outside the firm's control, in influencing adoption intentions.

Essay-3 advances extant IS research in three ways. First, with some exceptions, prior IS research has largely focused on understanding the *information sharing* behavior and not as much on the *information seeking* behavior, which is also important for a community to thrive and importantly for patients to benefit from. Thus, there is a gap in our understanding of the various factors that can influence knowledge (information) seeking behavior. This research addressed this gap in our understanding by examining the differential effects of system design on both health information seeking and sharing behavior. Second, this research advances theory by integrating two well established literature streams, loafing and silence which have largely been studied in silos. Extant IS research has viewed failure to participate in a knowledge/information sharing activity as a case of intentional free-riding. While this stream of IS research has enriched our understanding of factors that might drive non-participation, the present research makes the case for taking a different perspective at the non-contribution behavior. Specifically, by drawing on the rich stream of research on employee silence in OB, this research argues that member non-contribution or failure to *speak up* could also be on account of concerns about consequences to self. Third, recent IS research examined individual's willingness to share (provide access to) personal health information by considering the influence of type of information requested, the requesting stakeholder and the intended purpose on member willingness to share health information. The present research extends this research by considering the role of *system design* also in influencing willingness to share and seek health support.

Given the emphasis from federal government on empowering consumers and giving them control over their health information through initiatives such as *Blue Button*, this research

suggests that even simple interventions such as minor system design interventions can serve to empower users over how their identity is associated with their postings. Also, the findings of this research suggests that OPC administrators can safely consider opting for a *user preference* (selective anonymous) mode if they are currently offering only an anonymous or a non-anonymous OPC.

FUTURE RESEARCH

This research sets the ground for future research to build on and further our understanding of the dynamics involved in driving consumer adoption and usage of health IT systems. There are several opportunities for future research to build on the essays in this dissertation and they are listed below.

First, given the finding that social influence is an important predictor of health app adoption intention, it would be valuable to study the phenomenon from a social network perspective. Recent IS research shows how one's social network could play an important role in both driving (Sykes et al. 2009) and undermining (Venkatesh et al. 2011) system use. For example, it is possible that availability of peer support (Sykes et al. 2009) could potentially influence older people and those with low IT literacy also to consider using these health apps in the management of their health and wellness. However, given the homophily nature of networks (McPherson 2001), it is likely that older people and those with poor IT skills are also likely to be flocked by similar other individuals. Thus, research is needed to understand how peer supporters could be seeded in social networks as a way of driving health app adoption. A more important question would be how ties to physicians and the physician's attitude to health apps could affect consumer (patient) health app adoption. There is research to suggest that physicians could potentially have a negative influence on system usage of even out group members such as nurses

(Venkatesh et al. 2011), as they are lower in the hierarchy. Combined with findings that patients feel compelled to defer to physician's opinion to avoid being labeled *difficult* (Frosch et al. 2012), it is likely that physician's attitude of health apps and their recommendation could *seal the deal* when it comes to consumer adoption of health apps. Since many health apps give health related advice and suggestions, one is not clear whether physicians are likely to recommend using or avoiding health apps. Thus future research that examines the influence of one's social network and one's ties with physician and the resultant influence on adoption and usage of health apps is needed.

Second, research to identify specific design features that can inform health app development is required. Given that the purpose of the health apps is mainly to ensure that the user adheres to healthful behavior (such as engaging in regular physical activity or avoid excessive calorie intake), one useful lens to consider is self-regulation (Carver and Scheier 2001). Research is needed to understand what specific features can afford motivation (Zhang 2008) to the user to engage in self-regulation. For example, apps could give motivational messages to encourage the user to stay on track to reach the goal. In the context of research findings of this study, future research could explore what design features could influence perceptions of enjoyment, social influence and facilitating conditions.

Third, future research must consider the role of individual differences and their influence in adoption and usage of health apps. For example, recent research in group collaboration shows that goal striving or the tendency to persist at a goal to accomplish it can be an important predictor of performance (Srinivasan et al. 2012). Being so, it would be interesting to know what the implications of a health app sending reminders and motivational messages to such users are.

It is possible that there could be a boomerang effect, when individuals who are already high on self-regulation are regulated by an external agent such that they choose to not engage in a physical activity at the insistence of an external agent. Thus, there could potentially be a quadratic relationship between extent of regulatory support afforded by the app and compliance behavior for individuals already high on self-regulation. Other individual differences of interest in this context would be an individual's consideration of future consequences (temporal orientation) (Joireman et al. 2006) and regulatory focus (prevention/promotion focus) (Higgins 1997).

Fourth, privacy concern is an important factor to consider in the healthcare context (Anderson and Agarwal 2011). Although included in the model only as a control variable, privacy concern had a significant (negative) relationship with adoption intention. Given the fact that sharing details about one's workout routine, posting updates on weight (pounds) lost are all part of the enjoyment aspect, it would be interesting to know how privacy concern interferes with an individual's motivation to derive enjoyment by posting updates on one's health and health related activities. Future research could examine whether giving freedom of choice (Murray and Haubl 2011) to users whereby they could share some aspects of their health (low privacy items such as calorie intake) with their identity revealed and other aspects (high privacy items) anonymously would serve to undercut the negative influence of privacy concern on usage of health apps for hedonic purposes.

Fifth, future research must validate the findings of this research in the context of other consumer health IT systems listed in Table 1 in Essay 1 – such as health portals and online health communities. Such knowledge will inform theory and practice as to whether there could be different set of adoption drivers for different classes of consumer health IT systems. Considering

that Health IT systems such as online health communities wherein individuals share their health related information with others are much more prone to privacy invasions, it is possible that the individual's privacy concern could moderate the strength of the relationships found in this study.

Sixth, future research should further examine how *message framing* strategies could be employed to enhance perceptions of usefulness of the health app, as a first step towards driving adoption. In light of the findings from Essay-2 it appears that gain-framed messages (messages that highlight the benefits of complying) are more likely to be effective than loss-framed messages (message that highlight the consequences of failing to comply) in driving health app adoption. This is consistent with research findings in healthcare that suggests gain-framed messages are more likely to be effective in driving healthful behaviors (e.g., Detweiler et al. 1999). However, further research is needed to understand whether negatively framed messages might be more effective under certain circumstances. For example, on account of individual differences such as temporal orientation or regulatory orientation (promotion / prevention focus), negatively framed messages may be more appealing to some individuals. Also, research is needed to understand the intervening mechanisms through which message framing affects perceived usefulness.

There are also several rich opportunities for future research to consider in building on the findings of Essay-3. First, while this research examined what kind of design would encourage members to seek and share help an equally important question to explore is what type of response would be *actually used* by the member who sought help. That is, whether members would feel comfortable getting a health related advice from an anonymous source? While anonymous systems might serve to facilitate unhindered seeking and even sharing of health information, whether the information thus received would be acted upon is an important question

to consider. Thus, there is an opportunity for future research to understand how information should be served so that they are also acted upon (used). One example would be to employ gatekeepers whose function would be to collate and rate the various contributions received in response to a member's request. Subsequently, only the information deemed as credible by the gatekeeper could be passed on to the requester. While this can largely enhance the confidence in the response received, one also needs to consider the logistics of executing gatekeeping functions in real time, especially in communities with hundreds of thousands of members.

Yet another avenue for future research to consider is to employ a two-stage filtering process. For example, all member contributions could be made with identity revealed in the first stage. A pool of experts could evaluate the contribution and assign a score to the contributor and the specific contribution. In the second stage, only the contribution is passed on to the requester along with the credibility score of the contributor. Research is needed to understand how to facilitate such two-step abstraction process in a relatively reasonable time. Also, of concern is the privacy threat in a member's identity being known to the pool of experts. Thus research in this stream has several interesting questions to find answers to.

Third, research is needed to understand how *member identification* with the community could be enhanced as a way of curtailing member turnover, which are characteristic of online communities. With a growing number of OPCs available online, the administrators of these communities are faced with the challenge of containing member switchover to other communities. Thus, research in OB on workgroup identification and organizational identification could be leveraged to understand how members can be made to identify themselves with the community that they are part of. This is in particular a major challenge in anonymous

communities where the presence of other members is not as salient as in a community where other's identities can be seen.

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