



The impact of post-adoption beliefs on the continued use of health apps



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ABSTRACT

Background: Recently, there has been a rapid increase in the development and use of health apps on smartphones. In spite of research on such technologies, there exist considerable gaps between health app use and our understandings of such technology. Therefore, this study explored the process of leading people to keep using health apps, mainly based on the post-acceptance model (PAM).

Purpose: Despite significant previous research on health apps, few studies have focused on the post-adoption behaviors of using these technologies. To address and fill the gaps in health app research, this study has developed and tested a model to explain the micro-mechanism that determines the continuance intention to use health apps, theoretically relying on the post-acceptance model (PAM) and the technology acceptance model (TAM).

Methods: A sample consisting of 343 Korean adults who were currently using health apps on smartphones participated in an online survey. A path analysis was conducted to test the proposed model composed of the main factors from PAM and TAM.

Results: The results from the path analysis indicated that the following perceptual and emotional factors—perceived usefulness, perceived ease of use, confirmation, and satisfaction—were significantly associated with the continuance intention to use health apps on smartphones.

Discussion/Conclusion: Main findings from this present study contribute to developing and empirically testing a model of explaining the basic process of motivating health app users to keep using those apps. This model will be helpful for researchers to further examine health-related technologies, particularly mHealth-oriented ones.

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1. Introduction

Since the development of smartphones, our everyday lives have largely relied on their various functions. The field of health management is no exception to this trend. As our life expectancy continues to increase, people have shown increasing interest in finding ways to manage their health better and more efficiently. As a result, as has been widely noted, a large proportion of mobile phone owners have used their phones to actively search for online health information [1]. In addition to gathering health information, many people proactively manage their own health by using a diverse range of smartphone apps [2]. Primarily because of their high mobility, mHealth mobile apps have moved to the spotlight, as the dominant choice for users [3,4,5]. In 2014, the number of health apps on smartphones exceeded 100,000 over the world [6].

According to a 2012 Pew Research Center report [2], approximately 19 percent of smartphone owners use health apps. They rely on health apps for a range of diverse purposes, including medical education, diabetes management, and pain management [7]. Moreover, according to the Fifth Annual Makovsky/Kelton “Pulse of Online Health” survey, 66 percent of Americans were willing to use mobile apps for health purposes in 2015 [8]. The same report revealed that Americans chose to use health apps to track diets and improve nutrition, identify symptoms, and increase physical activity, as well as to provide medication reminders [8].

There has thus been a continuous and rapid increase in health app use. By focusing on this notable phenomenon in relation to mHealth, new research has developed more efficient health management apps [4,9,10], while also exploring the key factors that motivate users to adopt new health-oriented technologies [11,12,13]. However, despite the huge number of health apps that have sprung up everywhere, only a small number of apps (such as *Noom Diet*, *Nike+*, and *Lose It*) are successful across the whole mHealth market. Moreover, in spite of the considerable

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usefulness of health apps in helping people to effectively manage their health, people's use of those technologies often lasts only for a short period of time. Nevertheless, because this is still a new phenomenon, we know very little about the post-adoption behaviors of people using health apps on their smartphones. This suggests a need to delve more deeply into health app users' post-adoption behaviors. Therefore, unlike previous research on the adoption of health apps, this present study pursued an exploration of the psychological mechanism that determines health app users' continuance intention to use such technology, through the application of the post-acceptance model (PAM)—a model often used in studying post-adoptive behaviors [14].

In addition, in order to extend previous studies' findings to wider contexts, this study focused on health app use in Korea, primarily because of the following reasons. Korea is well known as an IT powerhouse, boasting high Internet penetration rates [15]. According to the Korea Internet & Security Agency, Internet penetration reached close to 100 percent in 2012 and has been continuously increasing. In addition, Korea has been ranked as one of the top countries in terms of smartphone ownership, showing an ownership rate of 84 percent in 2014 [16]. Accordingly, people's app use has also continued to increase, and smartphones have become one of the most dominant technologies in the everyday lives of Koreans. Therefore, an investigation of health apps from a Korean sample will produce deeper understanding of the use patterns of health apps in more advanced contexts in terms of IT infrastructures.

This study's investigation of health app users' post-adoptive behaviors in Korea will be theoretically meaningful in the following ways. First, this study's main findings will contribute to further examining the theoretical power of PAM. Although there have been a number of previous studies applying PAM to various technologies, there still remains a necessity to extend the particular model to additional new technology contexts. This is mainly because any psychological model that explains human behaviors is bounded by the unique functional characteristics of a chosen technology. Therefore, this study's focus on health apps will help researchers examine the predictive power of PAM. Second, the selection of Korea as the research site will also contribute to comprehending the contextualization of PAM. That is, the application of a specific model needs to vary from one context to another. Due to the diverse social, economic, and even cultural factors, a model cannot be applied to multiple contexts in a uniform way. Therefore, this study's findings in regards to the Korean context can expand the theoretical scope of PAM.

2. Theoretical framework

2.1. Research on health apps

As discussed above, we have observed a rapid increase in the development and use of smartphone health apps. Paying attention to this new phenomenon, a growing body of research has intensively investigated health app uses from various perspectives [17]. Overall, previous studies of health apps can be categorized into the following areas of research. First, a group of studies have focused on exploring the general characteristics of various health apps, paying major attention to design and functional aspects of health apps on smartphone. In other words, given the need to develop useful taxonomies for a large number of health apps, previous studies have categorized health apps by their main functions [11,17,18], using content analysis to scrutinize specific functions in detail. For instance, West et al.'s study identified three categories—predisposing, enabling, and reinforcing—of health apps, based on the main functions provided by those apps [18]. Considering the fast increase of health apps for various

purposes, this group of studies has provided useful taxonomical tools for summarizing the numerous health apps into a manageable number of categories. Such taxonomical tools help researchers conduct analyses of more specialized health apps rather than of general health apps. However, because those studies were seldom reliant on primary data collected from health app users, they hardly allow researchers to understand the perceptual and behavioral aspects of health app use.

Next, another group of studies have further explored the links between primary app functions and actual health-related behaviors [19,20,21]. Those studies have often been dependent on the perspectives of human computer interaction, linking design-oriented aspects of health apps to behavioral changes, mainly based on behavior change theories. That is, while the first group of studies mainly categorized health apps based on the main purposes and functions of the apps, the second group of research has taken effort to evaluate the design-oriented user interfaces of health apps depending on behavior change theories. A study by West et al. [20], for example, used health behavior theories to investigate the ways in which health app functions were being appropriately matched to behavioral patterns. Paying more attention to health apps specialized for cancer survivorship, Dahlke et al. also applied health behavior change theories to the evaluation of better interfaces in regards to human computer interaction by coding and analyzing design-oriented aspects of those apps [22]. While these studies' main findings have helped to explain the design-oriented aspects of health apps, their main limitation has been a lack of concern for the actual ways in which health apps are being used. In other words, because of their heavy dependence on the analysis of coded data about designed-oriented aspects of health apps, such studies seldom collected and analyzed people's actual attitudes toward health apps and their behaviors in using those technologies. For this reason, more research needed to explore the behavioral, perceptual, and emotional aspects of health app use.

Another group of studies has primarily examined the efficiency of mobile health apps for diverse health-related purposes [4,9,10,23,24,25,26,27,28,29]. Unlike research based on content analysis, these studies have investigated actual behavioral patterns in the use of specific health apps and have worked for developing more effective smartphone apps. Most of these studies have aimed to develop health apps to address a specific health issue (e.g., weight loss, diabetes, stress management, or mental health). Methodologically, they often use an experimental approach: letting participants actually try out the app and review their experiences. For instance, Årsand et al.'s research on diabetes investigated how a mobile app—Few Touch Application (FTA)—could be effective in managing diabetes [9]. In addition to this study, a larger portion of previous studies have intensively examined the functional efficiency of health apps specialized for specific purposes. The main findings from these studies have helped to develop better functions and more efficient interfaces for health apps. Despite their practical and theoretical contributions, these studies do have a main limitation: they cannot assess the processes of which particular types of apps are actually being adopted and used by individuals. In other words, although they can provide meaningful guidelines for developing technologically and functionally efficient apps, it is relatively difficult for those studies to lead app developers and healthcare practitioners to induce their patients to actively adopt and use them.

In response to the main limitations of these two groups of studies, other researchers have dug further into the micro-processes of adopting and using health apps [12,13,30]. Some studies in particular (generally those that apply a range of motivation theories, including the theory of reasoned action, self-determination theory, and the theory of diffusion of innovation), have exploited various constructs to determine the factors influencing people's adoption

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