

Healthcare Services and a Smart Water Bottle for Early Seniors: A Design Concept Based on a Goal-Directed Design Process

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Abstract. In their old age, people's central nerves, which make us feel thirst, tend to slow down and their body lacks water, and thus falling into dehydration. In order to identify ways to promote sufficient water intake, meet the needs of elderly people, and provide them with insight, survey and in-depth interviews were conducted. Based on the results obtained from the survey and in-depth interviews, this study addressed the use of a smart water bottle and the structure of healthcare services in fostering correct water intake habits. The goals of this research were to generate solutions for the improvement of water intake habits and, therefore, to help elderly people who cannot feel thirst, particularly early seniors in their 50s and 60s, to consume water easily, enabling them to lead healthy and happy lives in old age.

Keywords: Early seniors, water intake, service design, water bottle, health care

1 Introduction

Water supports health by flushing wastes from the body as well as increasing metabolic rates and the ability of respiratory organs to fight disease. A water intake survey (female = 1912, male = 1423, mean age = 49.4 years, SD = 16.75) revealed that 91.4% and 79.3% of participants aged 19-64 years and elderly respondents older than 65 years, respectively, did not reach the recommended daily intake. This finding indicates that a number of respondents, particularly the elderly, did not reach the recommended daily water intake. [1] If they lack water in their bodies, then they could experience problems with their metabolism, and be vulnerable to various diseases. [2], [3]

Impaired central nervous system function contributes to a lack of perceived thirst among the elderly, making them more easily dehydrated and more susceptible to issues associated with dehydration compared to younger adults; therefore, intense management and education are required to promote sufficient water intake. [4]

This study aimed to foster correct water intake habits in early seniors in their 50's and 60s and proposed a smart water bottle and health care service design to promote healthy and happy lives for individuals who may live to be 100 years old. Further, on the basis of Cooper's "goal-directed design" methodology, which is a user-centered

method, we conducted a survey and in-depth interviews, generating solutions for users' needs and providing insight in this regard. [5]

2 Survey and In-depth interview

We conducted a survey and in-depth interviews to assess water intake behavior and other related issues. First, a survey regarding water intake behavior was conducted on 60 subjects in their 50-60s who enjoyed climbing and jogging (female = 30, male = 30, mean age = 56.7 years, SD = 3.9).

Second, an in-depth interview was performed on 10 subjects in their 50-60s to understand new senior lifestyles and investigate their water intake behaviors and purposes (n = 10, female = 4, male = 6).

2.1 Results

All respondents were aware of the importance of water intake; however, 75% reported not feeling thirsty and 47% ingested water intentionally for health even when they were not thirsty. Their primary reason for not intentionally ingesting water, 'do not feel thirsty,' accounted for 73.5% of responses, indicating that this was the largest obstacle for water intake.

Of water intake behaviors queried, a considerable number of respondents were not familiar with correct water intake methods and claimed difficulties in building steady water intake habits.

Drug administration is one variable that affects water intake. Among study respondents, 78% were administered drug treatments and 72% drank more than 1 L of water daily. Most respondents reported stress around drug administration, which also negatively affects water intake.

In terms of lifestyle, the respondents were still actively involved in social activities, felt themselves young, and actively enjoyed civilized living. They also showed high levels of interest in water intake, including having individual portable water bottles for outdoor activities.

As a result, they required information regarding the state of their bodies, particularly in relation to hydration, as well as the formation of water intake habits. Further, this study applied drug administration, as the majority of the elderly persons were undergoing treatment.

3 Users' Needs and Insights

3.1 The Design of a Smart Water Bottle

Self-directed Health Care. Drinking water is an instinctive and ordinary behavior and forming new habits is not easy. Motivation is necessary to change behaviors and form healthy and positive water intake habits.

Based on Internet of Things (IOT) technology, in this study, a smart water bottle was designed and equipped with a weight sensor system and other functions, to facilitate the development of positive water intake habits. The bottle could also automatically detect water volume and had an alarm function to alert users when it is time to consume water. Importantly, the alarm offers a planning function, which enables the recording and management of water intake details, then rewards users with membership points, based on water intake. This ultimately facilitates consistent motivation to consume water and improves users' intake behavior, by giving them a sense of accomplishment and self-esteem in relation to the management of their own hydration.

Convenience of taking medicine. According to survey results, a large proportion of early seniors (78%) require drug treatments. However, preparation of water and medications may be cumbersome and lead to missing drug administration times. Based on the close relationship between drug administration and water intake, the design should also reflect drug administration habits to simplify administration and overall water intake. This would be accomplished with a design of water bottle that combines water and medication storage and provides an alert when drugs should be administered. These measures satisfy the requirement for 'simple drug administration', thereby improving the overall water intake experience.

3.2 Health care service design

Customized hydration management. According to the U.S. National Institute for Health, one third of modern diseases are due to water imbalance in the body, predisposing individuals to inadequate water intake; therefore, the correct water intake can prevent diseases by one third [6]. It is helpful for early seniors to adopt correct water intake habits, especially if they are aware of their hydration levels and the amount of water that they need to ingest. Establishment of a systematic hospital-connected hydration management system would allow investigation of body hydration levels and provide customized water intake information to individuals. This service would go beyond the limits of a simple accessory for water intake to provide concrete and practical effectiveness for effective water intake management.

Additional services to improve mental health. The ultimate purpose reported by users for their water intake was 'for health'. Water provides 'health' rather than simply 'survival'. [7] Healthy life is defined as a balance of physical and mental health. Therefore, providing both physical (water intake) and mental health services can lead to improved water intake. Service measures to enhance mental health associated with water intake might include the following: through membership points obtained on the basis of water intake, users could use these points to enjoy involvement in diverse cultural activities, such as exhibitions, performances, and point donations.

This study indicated the use of a smart water bottle and healthcare services in the fostering of water intake habits among early seniors, so that they can lead healthy

lives. In order to meet users' needs and provide them with insight, by indicating the use of a smart water bottle and healthcare services, the following considerations were identified: To enable the formation of water intake habits, a smart water bottle with an alarm function indicates the appropriate time for water intake and drug administration. Further, it gives consistent motivation, by rewarding users with membership points, based on their water intake; users could use these points to improve their lives, such as attending exhibitions or performances, so as to improve mental health.

4 Discussions and Further Research

While a single cup of water might be considered beneficial excess water consumption can be toxic. [8] Investigation of early seniors showed high levels of interest in health and awareness of the importance of water intake; however, they lacked information on correct water intake and faced difficulties in managing steady intake.

Individual management is particularly challenging because it is hard to accurately measure and record water intake. Precedent papers and studies have emphasized the importance of water intake, but few studies have addressed intake behavior.

The design measure proposed in this study is very encouraging. It is aimed at developing a highly efficacious and practical water intake management planner that provides both diagnosis and prescription based on user water intake rather than simply providing suggestions and confirming ingestion.

However, this study is limited in that usability tests via prototype preparation and user testing have not been performed. Therefore, additional studies on Internet of Things' technology related to these services that produce prototypes and perform user tests are necessary to improve user interface and user experience.

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