A Usability Research for Developing and Deploying Chronic Pain Relief Treatment Applications for Older Adults

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Abstract. Chronic Pain relief treatment strategies have been shown to improve health outcomes and decrease the cost of healthcare for older adults living with chronic illness. Reliable health informatics applications, which allow older individuals to manipulate and review personal chronic pain related information have, in turn, been shown to improve chronic pain relief treatment outcomes by supporting learning and reflection. We identify the need for a handheld device infrastructure that facilitates the creation and deployment of such applications and describe our progress in developing and making available such an infrastructure, which we call "Pain Free and Fly". We discuss how the content of Pain Free and Fly. Follows from key strategies and results in the chronic pain relief treatment literature, and how its application programming application and related services can be leveraged by other researchers wishing to build an older adults' chronic pain health treatment applications. This investigation analyzed several tasks and collects the related information and opinion from observation and interview. Research findings are based on the outcome of the usability testing and investigation.

Keywords: Chronic pain · Older adults · Treatment · Usability testing

1 Introduction

Persistent pain is common among the aging population, much more so than in younger cohorts. Recent studies on pain found that 17 % of adults under 30 in Taiwan experience pain often compared with 57 % of older adults. The prevalence of pain in older persons (typically defined as 65 years or older by demographers, insurers, and employers) consistently demonstrates a substantial burden of pain, with reports of 28 % to 39 % of older adults in the community experiencing daily pain and 42 % to 73 % of older persons residing in nursing homes experiencing pain. Furthermore, undertreated pain has many potential detrimental consequences that affect the individual in question but also can

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burden their family, friends, and even society. These consequences include depression, anxiety, falls, malnutrition, reduced cognition, impaired sleep, functional disturbances, declines in socialization and recreational activities, increased health care costs, and reduced quality of life. Higher postoperative pain scores are related to longer hospital stays, increased time to ambulation, and chronic functional impairment, indicating that pain has a more potent impact than simply patient discomfort and needs to be addressed early.

Although it is clear that chronic pain can markedly impair physical function, emotional well-being and general quality of life for a large portion of the population, it is far less clear how sufferers of chronic pain can effectively manage their experience of pain. In particular, people may have difficulty identifying factors that trigger or finding method reduce their pain. In addition, current pain treatment programs may be limited to treating symptoms through medication and may ignore other contributing factors. Moreover, despite evidence that actively involving and educating patients about their care helps reduce pain levels [1]. It was not clear whether commercially available tools for pain treatment actually support people's understanding of the relevant factors and present this information in a useful tool.

Therefore, pain relief treatment strategy and technology tool seeks to empower older individuals living with chronic illness to improve their quality of life and health outcomes by making informed decisions and useful tool about actions and behaviors that affect older adults' health. In the past time, older patient taking part in such pain treatment educational programs are taught problem-solving skills which, combined with the disease-specific information and technical skills taught in patient education, enable them to identify health problems and take the actions necessary to overcome them [2]. Pain relief treatment strategies and technology tool have been shown to be effective in improving the health outcomes of older individuals living with diabetes, asthma, arthritis and other chronic illnesses.

Various pain relief treatment strategies and technology tool help older patients understand relationships between their health status and condition. As such, personal technology tool that helps older patients track and present this type of pain information can help improve their health outcomes and quality of life [3]. Such tools, which include network-aware medical devices, online remedy diaries, digital pedometers and a wide variety of other hardware and software, have received a great deal attention from academia and industry in recent years.

The purpose of the present investigation was to focus on the factors and design element critical to the effective treatment of chronic pain and to evaluate pain treatment tools currently available to the general public using these criteria as well as general human factors principles. To clarify the problems most relevant to pain treatment, we conducted structured interviews with two subject matter experts (SMEs). In addition, a usability analysis of an available pain relief and treatment tool names "Pain Free and Fly" was conducted with fifteen older adults and a heuristic analysis of two additional pain treatment tools available on the market was also performed.

2 Literatures

2.1 The Concept of Chronic Pain Treatment

Treating chronic pain can be challenging. And it may take several types or combinations of treatments before you find relief. Passive therapy (those treatment modalities that do not require energy expenditure on the part of the patient) can provide short term and instant relief during chronic pain flare-ups and is directed at controlling symptoms such as pain, inflammation, and swelling [2, 5]. These therapies can include massage, ultrasound, iontophoresis, paraffin (wax) treatment, light therapy, or traction. Passive therapies may be useful over the short term but have limited benefit for chronic pain conditions overall. The key to effective treatment, however, is still a combination of avoidance of migraine triggers, stress treatment and relaxation techniques, and non-medication symptom relief through the use of locally applied heat or cold, massage, hot showers, and rest in a quiet, darkened room [4]. Older adults benefit from complementary or alternative therapies such as relaxation techniques, training in relief hypnosis, biofeedback, yoga, aromatherapy, acupuncture, spinal manipulation, and homeopathic remedies is useful for relieving different kinds of pain. Moreover, traditional pain acupressure is most popular selection for facing chronic pain in Taiwan,

2.2 The Current Application to Chronic Pain Relief Treatment

Chronic Pain is complex, so there are many treatment options -medications, therapies, and mind-body techniques. Acupuncture and acupressure are types of traditional Chinese medicine. It needs to determine trigger points that the areas within the body's muscle groups that cause pain to be felt elsewhere in the body. It helps individuals and massage practitioners alike identify the relevant trigger points and focus on them for pain relief. These remedies relieve pain by manipulating the skin at key points. This prompts the body to release endorphins which can block messages of pain from being delivered to the brain. This preliminary research discuss some of the existing pain relief applications and clarify the continued works of usability testing.

Muscle Trigger Points Massage Therapy. The Muscle Trigger Points Massage Therapy application is an extensive compilation of common trigger points in a human body and their related referral patterns. When pain exists in a human body, it can generally be alleviated or mitigated through massage therapy by focusing on key trigger points that cause the pain. Unfortunately, most people do not know where these trigger points are. Many massage therapists also often struggle to truly pin point the appropriate areas of the body to work on in order to relieve specific types of pain in specific areas of the body. This application helps overcome all such challenges. This application is great for individuals who are interested in relief healing methods, massage therapists, physical therapists, chiropractors, or anyone else interested in finding the cause of their muscular pain and how to relieve it. This application features hundreds of trigger points throughout the entire body and shows you each trigger point's corresponding referral patterns (where the pain could exist in the body. Not only will users be able to visually see the

pain areas and trigger points, user will also be able to read about each (their causes and remedies). Further, you will find recommended exercises to prevent or mitigate such pain (Fig. 1).

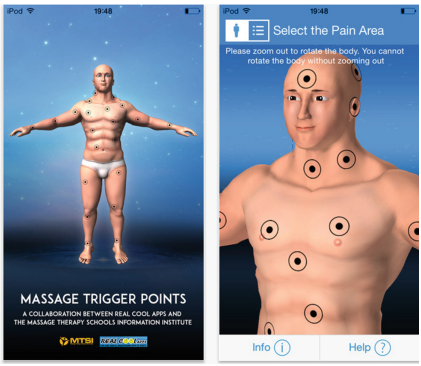

Fig. 1. Muscle trigger points massage therapy

Simply Health Back Care. The simply health Back Care app offers health information and advice to help user manage and prevent back pain. There are graphics and videos of exercises for user to follow and user can input the area and strength of user's pain to keep own pain diary. User can also search for practitioners near user from thousands of physiotherapists, chiropractors, osteopaths and acupuncturists. All information and exercises are supplied by the UK charity Back Care. With this app user will be able to record where and how severe own back pain is in the 'Me and My Back' diary. It can also watch and follow exercise videos and animated illustrations of common back pain relief and prevention exercises. Moreover, searching for qualified practitioners near user. User can also find information on preventing back pain: At home, in the office, When driving, When cycling exist (Fig. 2).

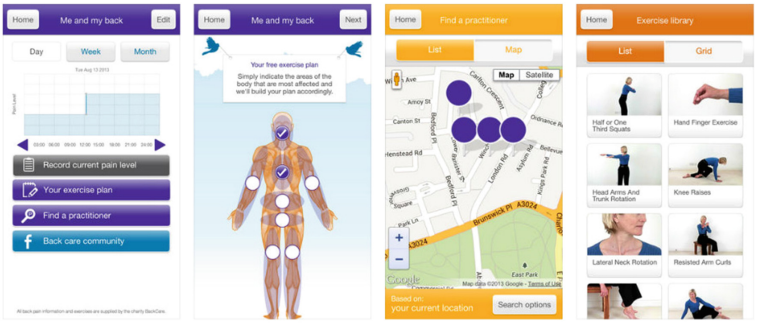

Fig. 2. Muscle trigger points massage therapy

3 Method

This research was conducted by means of usability experiment, structured questionnaire and interview. Each program's features were evaluated based on a set of common benchmark tasks. The experiment investigated the performance of chronic pain treatment programs on questionnaire. A structured questionnaire was utilized as a research tool for use opinion collection. The structured questionnaire consisted of three major dimensions: basic personal information, scale of computer skill knowledge, scale of instant message programs attitudes. Finally, the research conducted some short interview to discuss detailed behavior data and needs in order to be the references for the human factors concept development.

3.1 Participants

The sample for the usability investigation was composed of healthy, diverse older adults. Fifteen participants, four males and eight females, volunteered for this research. The mean age of the participants was 66.5 years (from 62 to 67 years, standard deviation 2.48 years). The participants were recruited from community classes for the elderly and through personal contacts. The older participants were asked to rate their computer skills on a Likert Scale from 1–5 (i.e., 1 = Not Skilled, 5 = Highly Skilled). One participant rate at level 1; nine at level 2; one at level 3; and one at level 4. These scores indicated a range of skills that could be discussed of this research. Although all but three participant had an Internet connection at home, their experience levels as information searchers were varied. Just only one participant was expert in using a variety of health-informedica application, while the rest were inexperienced as users, and had mainly head those titles. During the search session, all of the participants used the Android operating system to use the chronic pain relief and treatment application in Chinese. The sizes of the tablet monitors and resolutions were selected. The protocol was explained and informed consent was obtained from each participant.

3.2 Testing Procedure

The testing procedures consisted of the following steps:

1. The detailed program content was introduced to the individual participants.
2. Participants were given 10–15 min of free conducting the pain relief treatment programs to allow them to become familiar with the content.
3. Usability testing on chronic pain relief and treatment applications was conducted. Participants were required to perform tasks of the application. This research wanted to ascertain if there were additional problem areas that hindered interaction between participants. This research also wanted to gather data about how the participants encounter problems while using the application to accomplish interaction tasks. The tasks are shown as below:
   (1) Search for type of the pain
   (2) Take a photo to manipulate the location of pain
   (3) Acupressure of the pain location

3.3 Application for experiment-Pain Free and Fly

Chronic Pain is a highly complex disease that can have different characteristics for each person that struggles with it. In order to smoothly decrease and effectively treat chronic pain, older patients rely on such acupressure information and methods about personal condition as possible. Traditional pain acupressure that document a rough paper simply don't give the necessary details and procedure. The current Pain Free application with 18 different pain and remedy acupressure modules, chronic Pain Free and Fly provide health acupressure solution. It gives older patients the tools needed to capture, aggregate, and analyze this wide array of information into a format that older adults can use to best relieve chronic pain (Fig. 3).

Fig. 3. Pain free and fly

4 Discussion and Results

This study was carried out to find out the kinds of errors made by older novice users of a "**Pain Free and Fly**" Application of tablet computer. Due to the nature of the study it was impossible to identify with certainty the definitive causes of the errors from the users' side, but some errors may be related to the age of the participants, such as reduced visual capability: e.g. the text information on some of the controls was too illegible for older participants to see or be able to recognize. Another problem was reduced dexterity and muscle control (and in some cases in appropriate finger characteristics to operate a capacitive touchscreen reliably). The acupressure controls required very specific photo inputs to operate correctly, whether for press duration time, accuracy, speed or simply, the touchscreen capacitance range was calibrated to limited area. Other problems seemed to because by inexperience, older users having not enough transfer able prior technology experience, or by conflicting prior experiences. For example, there is sometimes a lack of explicit confusion on finger and palm controls, so older users do not have a clue what the control is meant to do. Another problem seemed to be a lack of confidence, making older participants hesitant to engage in a 'trial and error' exploration approach (Fig. 4).

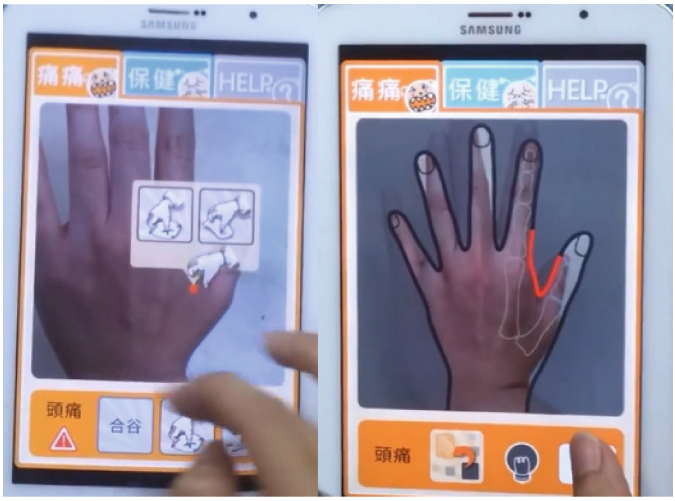

Fig. 4. The manipulation of area for acupressure

The main generic problems the participants encountered can be categorized as follows:

- Problems with operating the touchscreen reliably –both failed and repeated activations. The operation of the touchscreen appeared to be incorrectly calibrated for older users' fingers and palm capacitances, and so despite them carrying out what appeared to be the requisite length of time tapping, the device would simply not register a tap event.
- Confusion about how to move the finger and palm to the designated location. The touchscreen photo capture area required that older adults match to locations where they wanted the outline to be, rather than using the tab key in certain situations. This seemed problematic for older users who did not find it easy to learn to touch the screen to move the tablet, when was present.
- Conceptual problems, such as confusion between the concepts of acupressure modules (select and swipe to the left) and back (go to previous screen/back out of application). Older Participants seemed to transfer knowledge from prior experiences with non-digital applications (such as camera) and their limited digital experiences.

5 Conclusions

The information gleaned from the SME interviews helped identify the variables critical to pain relief treatment application, including physical acupressure guidance, area of acupressure, the acupressure quality, and side effect taking behavior. With such a large and complex body of knowledge, it is important to have some method of recording and clarifying the acupressure information. However, the usability and heuristic analyses revealed that current pain relief tool are limited in their ability to improve pain treatment and hence quality of life because of the absence of capabilities to support learning about

one's pain acupressure experience. Further, the tools' ease of use by older adults was compromised by various design characteristics that must be considered in future tools, such as clear layout, uninformative anchors on acupressure modules, and difficulty modifying certain hand-eye coordination and mapping settings. This study provides guidance for design of tools that facilitate the understanding of relationships between pain-relief treatment factors to improve pain treatment through older adults' lifestyle changes.

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References

1. Berman, R.L.H., Iris, M.A., Bode, R., Drengenberg, C.: The effectiveness of an online mind-body intervention for older adults with chronic pain. J. Pain **10**(1), 68–79 (2009)
2. Medynskiy, Y., Mynatt, E.: Salud! An open infrastructure for developing and deploying health self-management applications. In: 4th International ICST Conference on Pervasive Computing Technologies for Healthcare, Munich (2010)
3. Blondal, K., Halldorsdottir, S.: The challenge of caring for patients in pain: from the nurse's perspective. J. Clin. Nurs. **18**(20), 2897–2906 (2009)
4. Park, J., Cho, B., Paek, Y., Kwon, H., Yoo, S.: Development of a pain assessment tool for the older adults in Korea: the validity and reliability of a Korean version of the geriatric pain measure (GPM-K). Arch. Gerontol. Geriatr. **49**(2), 199–203 (2009)
5. McBride, S.E., Tsai, W., Knott, C.C., Rogers, W.A.: Supporting the management of osteoarthritis pain: a needs analysis. In: 55th Annual Meeting of the Human Factors and Ergonomics Society, Las Vegas (2011)