

# User-Centered Design of Smart Healthcare Applications

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## **Keywords: Healthcare Applications**

Recent developments in the area of information and communication technologies lay the groundwork for new patient-centered healthcare solutions. While the majority of computer-supported healthcare tools designed in the last decades focused mainly on supporting care-givers and medical personnel, this trend recently changed with the introduction of assistive technology for providing supportive and adaptive services to ill or disabled individuals. Several authors, like, e.g., Vergados et al. [1] or de Ruyter and Pelgrim [2], even expect the next generation of healthcare systems to be mainly based on the homecare idea, thereby extending healthcare from the traditional clinic or hospital setting to the patient's home.

The idea of smart homecare applications is to provide assistive technologies for supporting people with specific demands in their daily activities, allowing them to grow old in their own homes. This is usually done by enhancing physical spaces with information, communication and sensing technology to make them sensitive and responsive to the presence of people and provide assistive services in different areas of life. In this context, smart homecare applications are often cited as a promising solution to take care of elderly or disabled people. By providing a wide variety of services, including assistance to carry out daily activities, health and activity monitoring, enhancing safety and security, getting access to social, medical and emergency systems, and facilitating social contacts, smart healthcare applications bear the potential of bringing medical, social and economical benefits to different stakeholders.

From a medical point of view, smart healthcare applications provide an immense potential for enhancing medical care, especially in the light of an increased importance of early detection and preven-

tive care. Remote patient monitoring does not only enable effective therapy support and the detection of abnormal conditions in an early state, it also proved to contribute to a significant reduction of hospitalization and an increased success in long-term therapies [3]. But smart healthcare application could not only improve quality of service, they also have the potential to significantly reduce the costs of long-term care. For example, Heinze [5] expects potential savings of up to 30% through remote medical services for patients with cardiovascular diseases. Similar studies by Johnston et al [5], Gothe et al. [6] or Tang and Venables [7] come to equally positive results.

Today, research activities in the field of smart healthcare applications are dominated by professionals from engineering, informatics and medical sciences, who mainly concentrate on aspects of technical feasibility and medical treatment. But in order to fully exploit the potential of electronic healthcare applications, not only aspects of technical feasibility, but also acceptance and usability issues have to be carefully considered [8, 9]. Innovative healthcare and wellness solutions substantially depend on the patients' acceptance to use them. Facing the complexity of smart healthcare systems as well as the increasing diversity of users, contexts, and technology types, the concentration on a single design and evaluation approach does not seem to be sufficient anymore [10]. Individuals live in environments and expect technology to be adaptive and useful. However, what is judged useful may change depending on the application domain and usage context. With the increasing penetration of technology into private spaces, technology must comply with the needs and wants of a diverse user group in order to be successful and fully accepted by those for which it is designed. Therefore, it is important to

identify users requirements as early as possible in the design process, so that the needs and wants of different user groups can be appropriately addressed in the design of future systems.

The papers included in this special issue grew out of the 'The First International Workshop on Smart Healthcare Applications' held at the 21st Annual Conference of the Australian Computer-Human Interaction Special Interest Group of the Human Factors and Ergonomics Society of Australia (OZCHI) in Melbourne, Australia, from November 23 to 27, 2009. The articles present emerging research on different user-centered design issues of smart healthcare applications.

In the first paper of this special issue, Duncan Stevenson presents a case study of a distributed healthcare application supporting remote consultations for paediatric patients recovering from surgery. The study aims at investigating whether post-operative surgical consultations could be adequately conducted using point-of-care tele-health applications. The paper illustrates the process of acquiring requirements as well as the transfer of the identified requirements into the design of the consultation system. The paper successfully demonstrates that early clinical trials are a good mean for revealing important system requirements in an early phase of the design process and thereby contribute to a broader understanding of critical factors necessary to be addressed during the implementation of smart healthcare applications.

The second paper by Suelette Dreyfus and colleagues presents a theoretical model for personalizing the presentation of electronically generated test results with the goal of encouraging chronic disease sufferers to take appropriate actions for improving their health conditions. The authors apply approaches driven by theories of learning and persuasion in order to develop new techniques for supporting the interaction between healthcare providers and patients using personalized pathology reports based on individual patient values. The paper reports on the first stage of the design process and describes the initial analysis of consumer values as well as the development of a prototype application.

In the final paper, Martina Ziefle and Anne Kathrin Schaar report on the results of a user study analyzing gender differences in the acceptance of invasive medical technologies. The study focuses in particular on the perception of potential benefits and drawbacks associated with the usage of assistive medical technologies. The results of the study indicate that gender is a decisive factor influencing the adoption

of invasive medical technology. For female participants the perceived negative aspects had a tendency to outweigh the expected benefits with regard to the acceptability of the presented technologies. In addition, the results show that especially the concerns of female participants are often influenced by misperceptions about the nature and technological consequences of medical technologies.

The collection of papers included in this special issue obviously does not cover the whole spectrum of user-centered design approaches in area of smart healthcare applications. However, we hope that the selected articles provide a representative sampling of state-of-the-art research in the field and thereby serve as a good starting point further reading. In conclusion, we hope that this special issue will not only promote research on smart healthcare applications, but stimulate even more ambitious research activities in this interesting new field.

## Acknowledgements

As guest editors of this special issue, we wish to thank the editorial board of the electronic Journal of Health Informatics and in particular Editor-in-Chief Prof. Evelyn Hovenga and Managing Editor Dr. Sebastian Garde for offering us the opportunity to publish this special issue and their valuable support and encouragement throughout the editorial process. We would also like to thank all authors for their high-quality contributions and professional collaboration as well as our reviewers for their generous help and constructive comments, which helped to ensure the highest possible quality of the accepted papers.

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