Pers Ubiquit Comput (2015) 19:569–571
DOI 10.1007/s00779-015-0851-2

EDITORIAL

Aspects of ubiquitous computing for improved clinical practice

Ellen A. A. Jaatun[1] · Wendy MacCaull[2]

Published online: 2 July 2015

1 Introduction

Development of numerous web-based and mobile technologies and other computer programs supporting patients and healthcare workers has occurred, including apps for voice and image recognition, patient sensors, computer programs to enhance efficiency, cost-effectiveness, and tools for treatment. Effective use of the information from different devices and in different settings has great potential to improve the efficiency and efficacy of care; however, this requires collaboration among numerous stakeholders, including clinical and technological experts. Currently there is a major drive for further development of tools, but there is less focus on integrating existing tools with clinical practice.

The main goal for this special issue is to explore the link between clinical work processes and ubiquitous computing, focusing on context of use that has potential to improve current practice. Ubiquitous computing can therefore work as a driving force for clinical improvement. This special issue rose out of the 4th International Conference on Current and Future Trends of Health Information Technologies held in Halifax, Canada, 2014 http://cs-conferences.acadiau.ca/icth-14/. Authors of the best papers were invited to submit revised and extended versions of the submitted conference papers to this special issue, and an open call to the wider community was made. All papers underwent a rigorous refereeing process. The Conference Keynote speaker, Professor Jamal Deen, was invited to summarize his presentation as an invited paper in this issue.

The contributions of this special issue, considered below under the three headings, Framework and Work Process Evaluation, Overview and Changing Behavior, demonstrate the broad range of mobile technologies and other computer programs supporting patients and healthcare workers which are intended to improve clinical practice. The solutions presented in this special issue are based on handheld, wearable and mobile information devices and the pervasive communication infrastructure that supports them, enabling the seamless integration of technology with people in their everyday lives.

2 Contributions

2.1 Framework and work process evaluation

Healthcare settings are complex environments, and it is essential to understand processes and workflows involved. A systematic overview of the eHealth status was published by Black et al. [1] in 2008, where the authors point at the still missing "best practice guidelines for development and deployment of eHealth." As demonstrated by Klemets et al., from observing nurse calls from patients on the ward, the concurrent workflow may be simultaneous and require either prioritization and/or reallocation. To be made aware of both simultaneous events and needs for allocation of tasks, technologists and healthcare providers as well as patients need to be involved and help point out the issues and other domain knowledge. This requires an

✉ Wendy MacCaull
wmaccaul@stfx.ca

[1] Department of Otorhinolaryngology, Head and Neck Surgery St. Olav Hospital, Trondheim University Hospital and Department of Cancer Research and Molecular Medicine, Norwegian University of Science and Technology, Trondheim, Norway

[2] Department of Mathematics, Statistics, and Computer Science, St. Francis Xavier University, Antigonish, Canada

interdisciplinary collaboration methodology that assures information is comprehended and shared as well as implemented in the process. A framework, such as that, proposed by Mata et al., might make the expectations and the proceeding of the study clearer for the participants and thus improve collaboration and results. The authors present a case study where development of a mobile healthcare monitoring app is tested and refined and implemented as a part of the same study. This requires a close interdisciplinary collaboration and a realistic study setting. In any collaboration for development of a tool for patients, caution is needed. As suggested by different authors, patients are not to be seen as one unified group of people. A large number of patients are older, and specific attention to age-related impairments following older age is required to promote correct use of mHealth [2]. Subgroups of patients may also show specific needs that must be taken into account. Often patients with palliative care needs will be gradually more burdened by disease and require close monitoring by healthcare providers. This surveillance may be improved if they can provide feedback that is considered helpful and useful by both patients and healthcare providers. The tailoring of tools to these groups of patients and the needs of the healthcare professionals is challenging. Jaatun et al. suggest some guidelines on design and propose measurement of characteristics of patients intended to define the user and contribute to the definition of for whom a particular eHealth tool is appropriate.

2.2 Overview

In a software development setting, a review of "what we already know" is important; however, reviewing scientific evidence in the healthcare informatics field can be challenging. The channels for publications are interdisciplinary, and different search engines may be needed. These search engines operate differently, and knowledge about search terms and combinations of them is required. Another problem is that the requirements on "how to write a paper" vary in particular, with respect to how to write an abstract. This has potential to influence the inclusion of abstracts and consequently the results of the review. A systematical review is one method to summarize research evidence; another method is the systematical mapping, which seeks to get an overview of the field or topic. Farshchian et al. present the latter clearly and demonstrate its use by providing an overview of the field of falls among elderly. Falls, particularly among the elderly, often have major personal consequences as well as a socioeconomic burden. A great deal of research in this field has been performed and, as Farshchian et al. show, it may well be the right time to pause and find the future direction.

2.3 Changing behavior

Many software development projects have used a pragmatic methodology where problems are solved with the aid of revised methods and refined tools. Depending on the aspect and context of use, we are constantly challenged by the "moving target" in health care. In order to prevent disease from spreading inside the hospital, hand hygiene is very important. Tracking healthcare providers' interaction with a soap dispenser would provide crucial information of unutilized potential in the fight against nosocomial infections (hospital-acquired infections). Baslyman et al. suggest how to use a real-time location system to track and prompt hand hygiene among healthcare personnel. Changing behavior by implementing a system has more than once proved to be problematic. It is important that the workflow supported by the technology is sensible and valuable. Sometimes the use of technology requires using functionalities or ticking boxes that are not perceived as meaningful. To track a process and remove "non-value" functionalities can save time and improve user satisfaction. Khodambashi presents how the lean method can be used to compare a clinical process and the health information system (HIS) implemented to support the process. The lean method can identify "non-values" and thus be used to tailor the HIS to the clinical process.

Providing high-quality health care to a rural community by making better use of the local resources is a major challenge. Osmundsen et al. present a case study where healthcare providers and patients with diabetes work together in order to improve service and provide better care. To enhance learning and support implementation of new guidelines and acquired knowledge, videoconferencing is used. The evaluation of this process concluded that a tripartite constellation among the participants was perceived beneficial for all parties. The invited paper, "Information and Communications Technologies for Elderly Ubiquitous-Healthcare in a Smart Home" by Jamal Deen, introduces several noninvasive and user-friendly sensing and actuating systems using information and communication technologies, thereby creating engineering solutions to some pressing healthcare problems, especially pertaining to the elderly. These solutions are designed to allow the elderly to lead independent lives while being monitored to permit early detection and timely recommendations for improved health and well-being. Deen makes a strong case that advances in information technology, wireless communication, sensors, actuators, information fusion, computers and automatic computing can be effectively used to develop new, smart, cost-effective solutions for ubiquitous healthcare (U-healthcare) applications.

3 Conclusion

In this special issue, the aim was to explore the link between clinical practice and ubiquitous computing. Our cross-disciplinary contributions cover some fundamental aspects in the field of health informatics. To ensure perspectives on various viewpoints in studies like this, knowledge of the domains involved is required. To this end, we organized a review process in which every paper was reviewed from both the medical domain and the technological domain. From our perspective, we believe that the review process might have been challenging for some as it required placing the research in both the medical and technological domains. However, we trust that this promotes the best end results for both authors and readers. We hope and believe that the authors and their papers have benefitted from this process. We also hope that the reviewers found the time spent worthwhile and the process beneficial.

Ubiquitous computing has the potential to greatly enhance healthcare provision in many ways. Its success will continue to depend both on advances in technology and on the continued interactions and close cooperation of the scientists with the clinicians and patient populations for whom the technology is designed.

Acknowledgments We would like to thank the authors of the scientific papers for their hard work, and we are grateful for the efforts of the reviewers. We also would like to thank the editors of Personal and Ubiquitous Computing for allowing us to prepare this special issue.

Appendix: International program committee

- Wendy MacCaull, St. Francis Xavier University, Canada
- Ellen Jaatun, NTNU, and St Olavs Hospital, Norway
- Yngve Lamo, Bergen University College, Norway
- Gry Seland, Gjøvik University College, Norway
- Craig Kuziemsky, University of Ottawa, Canada
- Liam Peyton, University of Ottawa, Canada
- Bård Erik Kulseng, NTNU, Norway
- Davy Preuveneers, KU Leuven, Belgium
- Samina Abidi, Dalhousie University, Canada
- Tonje Omundsen, NTNU, Norway
- Andreas Schrader, University of Lübeck, Germany
- Babak Farshchian, NTNU, Norway
- Tobias Mettler, University of St. Gallen, Switzerland
- Ragnhild Helleso, University of Oslo, Norway
- Soudabeh Khodambashi, NTNU, Norway
- Gunhild Heggem, NTNU, Norway
- Trine Bergmo, Norwegian Centre for Intergrated care and telemedicine, Norway
- Weichang Du, University of New Brunswick, Canada
- Ridha Khedri, McMaster University, Canada
- Heather Jewers, St. Francis Xavier University, Canada
- Daniel Amyot, Unversity Of Ottawa, Canada
- Michaela Huhn, TU Clausthal, Germany
- Martin Gilje Jaatun, SINTEF ICT, Norway
- Hege Andreassen, Norwegian Centre for Intergrated care and telemedicine, Norway
- Kari Dyb, Norwegian Centre for Intergrated care and telemedicine, Norway
- Jane Liu, Academia Sinica, Taiwan

References

1. Black A, Car J, Pagliari C, Anandan C, Cresswell K (2011) The impact of dHealth on the quality and safety of health care: a systematic overview. PLoS Med 8:188
2. Wildenbos GA, Peute LW, Jaspers M (2015) A framework for evaluating mHealth tools for older patients on usability. IOS Press, Amsterdam