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The Changing World of Healthcare Professionals

When you think about the digitalization of healthcare, several good examples of how computer science has contributed to pioneering digital development might come to mind. Just to give you a notion, digital systems for monitoring, e.g., heart activity, can save lives for patients as well as unborn babies due to early detection if something is wrong. Robotic-assisted surgery has the potential for greater precision than a human surgeon when used in minimally invasive surgeries, such as laparoscopies, which obviously is more beneficial for the patient. Magnetic resonance imaging technology have enabled faster contrast scans, which has greatly improved imaging workflow of the heart and allowed for magnetic resonance scans of the lungs. Additionally, digital medical records have facilitated information exchange between different caregivers and between caregivers and patients. These are just a few illustrations of how digitalization and computer science have improved healthcare, but the examples are countless.

Digitalization in healthcare is for the better from many perspectives—for patients, as well as for health organizations, healthcare professionals, and society in general. Digitalized healthcare provides safer treatments and care, which in the end contributes to more lives saved and a higher proportion of people who are cured of their disease(s). This implies a higher proportion of working age people (and those who will be working age) will be healthy enough to work, and thus financially contribute to society. Healthcare professionals are also assisted by digitalization, which can facilitate their work duties and give them support in everyday work.

As you may have recognized by now, this edition of *XRDS* is about changing healthcare with respect to digitalization. Even though digitalization has greatly improved healthcare from many points of views, there are still many aspects that have the potential to improve. This issue will focus on the perspective of healthcare professionals, including their experiences and thoughts about the digitalized work environment.

From a contemporary perspective, certain healthcare professions (e.g., medical secretaries) have almost become unnecessary today due to digitalization. More forward looking, additional healthcare professions, or at least typical work duties related to certain professions, will likely be replaced by robotic-technology and artificial intelligence assistants in the future. What happens then, and what are the pros and cons of this development from different perspectives? Other questions that will be discussed in this edition are contextual and reflect potential barriers between the digitalized work environment and healthcare professionals. From the developer's perspective, what is important knowledge to know about healthcare and healthcare organizations in order to develop information systems and interfaces that are as good as possible for end users? What are the barriers in healthcare organizations that prevent many healthcare professionals from efficiently adapting to new information systems and improving their digital literacy? Additionally, what features in the digitalized work environment contribute to increased job demand, as well as experiences of technostress? What individual and organizational consequences may that cause? These, and more, questions will be further discussed in the articles presented within. In order to provide a more comprehensive picture of the way digitalization has changed healthcare, we have invited authors from various research disciplines.

First up is Sofia Hernnäs, Ph.D. student in national economics at Uppsala University, who describes how

It is estimated that Google consumes the energy of 200,000 households each year.

digitization is changing healthcare from a national economics perspective. She discusses the potential consequences of digitization in healthcare due to automation, and reflects upon whether some healthcare professionals will be replaced by machines in the future.

Magdalena Stadin, a Ph.D. student at Jönköping University, focuses her article on occupational health. Stadin introduces readers to the causes of technostress associated with ICT demands faced by healthcare managers—for instance, the misfit between the information system and healthcare. Suggested strategies to deal with these issues are discussed, from an organizational and an end-user perspective.

Claus Bossen, associate professor at Aarhus University and an eminent figure in the field of computer-supported cooperative work, shares how healthcare digitization has made certain types of work unnecessary, while at the same time leading to the emergence of new types of tasks and new work roles to handle these tasks. In his article, Bossen focuses particularly on medical secretaries and medical scribes, occupations that play an essential role in healthcare but are rarely the focus of research.

We then move to a different work context: nurses working with patient-collected data at a pelvic cancer rehabilitation unit. Kateřina Černá, a postdoctoral researcher at Siegen University, describes how critical care nursing practices and relationships between nurses and cancer patients changed once those patients were given a self-monitoring tool. Černá also shares the lessons learned from using a participatory-design approach to create the tool in question, highlighting the importance of including healthcare staff in the design process.

In the next article, Eva Anskär, district nurse at a medical center in Sweden and beholder of a licentiate degree from Linköping University, immerses us in the daily life of primary-care staff in Sweden. She shares with us the results from a survey she conducted in order to investigate how staff working in Swedish medical centers spend their time, and how these time-use patterns affect their perception of their psychosocial work environment, in particular when it comes to "illegitimate" work tasks. Anskär also highlights the role bad IT systems play in this dynamic.

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André Kochanke, a software engineer from the company Go Reply, takes us a bit further into the design perspective, describing the challenges and constraints associated with the design of an automated shift scheduling application for nursing staff. He wraps up his article with some general recommendations for the design of healthcare tools—including areas and features where machine learning could be beneficial.

Research engineers Siva Teja Kakileti, Himanshu Madhu, Thara Subramoni, and Geetha Manjunath from the Indian tech startup NIRAMAI further explore the potential of machine learning for healthcare devices. They describe the functioning of a thermography-based device aimed at providing non-invasive breast cancer screenings, specifically in developing countries.

Next we meet Anna, a 47-year-old homecare nurse. Christofer Rydenfält and Johanna Persson, both associate senior lecturers at Lund University, witness the daily issues she encounters when interacting with the electronic health record. Rydenfält and Persson use this example to discuss how such issues have been and can be looked into from a human-computer interaction perspective. They stress the need for adopting a holistic perspective when tackling the implementation of electronic tools in healthcare, all the while keeping a sharp focus on the design of the interface.

Finally, Peter Anderberg, associate professor at Blekinge Institute of Technology, addresses digitalization and the "silver economy," which refers to the increased use of technology versus the increasingly aged population. This article provides arguments for increased use of technology to support healthcare professionals, as well as the elderly in need of healthcare services.

—Magdalena Stadin and Diane Golay, Guest editors

Biographies

Magdalena Stadin is a Ph.D. student in health and caring science at Jönköping University, Sweden. She is also currently a guest Ph.D. student in human-computer interaction at Uppsala University. Stadin has a bachelor's degree in psychology from Örebro University, and a master's degree in public health from Uppsala University. Her research concerns technostress related to ICT demands, and how it is associated with health in different occupational groups. Currently, Stadin is working with an interview study with healthcare managers with regard to their digitalized work environment.

Diane Golay is a Ph.D. student in human-computer interaction at Uppsala University, Sweden. Her main research topic revolves around the impact of ICT use on employees' work and psychosocial work environment. The focus of her current studies lies on nursing staff's experience of computerized systems for patient care. She has a B.Sc. in information science and a MSSc in human-computer interaction. She is passionate about user-centered design and dreams of bringing together computer science and design students in order to foster the development and implementation of innovative technology fitted to the needs of its users.

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