

Preface

Healthcare organizations and providers are facing the challenge of delivering high quality services to their patients, at affordable costs. High degree of specialization of medical disciplines, prolonged medical care for the ageing population, increased costs for dealing with chronic diseases, and the need for personalized healthcare are prevalent trends in this information-intensive domain. The emerging situation necessitates a change in the way healthcare is delivered to the patients and healthcare processes are managed.

BPM technology provides a key to implement these changes. Though patient-centered process support becomes increasingly crucial in healthcare, BPM technology has not yet been broadly used in healthcare environments. This workshop shall elaborate both the potential and the limitations of IT support for healthcare processes. It shall further provide a forum wherein challenges, paradigms, and tools for optimized process support in healthcare can be debated. We want to bring together researchers and practitioners from different communities (e.g., BPM, Information Systems, Medical Informatics, E-Health) who share an interest in both healthcare processes and BPM technologies.

The success of the first two ProHealth Workshops, which were held in conjunction with the 5th and 6th International Conferences on Business Process Management (BPM'07 and BPM'08), demonstrated the potential of such an interdisciplinary forum to improve the understanding of domain specific requirements, methods and theories, tools and techniques, and the gaps between IT support and healthcare processes that are yet to be closed.

The 3d International Workshop on Process-oriented information systems in healthcare (ProHealth '09) was held in Ulm in conjunction with the 7th Int'l Conf. on Business Process Management (BPM 2009) dealt with different facets of process-oriented healthcare information systems, and gave insights into the social and technological challenges, applications, and perspectives emerging for BPM in this context.

Enterprise-wide process-oriented information systems have been demanded by healthcare institutions for over 20 years and terms like “continuity of care” have even been discussed for over 50 years. Yet, healthcare organizations are currently using a plethora of specialized non-standard information systems and continue to focus on development of systems for specialized departments that frequently only focus on their internal processes. Many of the successful existing information systems focus on non-process oriented systems, such as imaging, drug order-entry, laboratory test result storage, storage of diagnoses and progress notes in electronic medical records, alerts and reminders, and billing applications.

Information systems and decision-support systems for managing *patient care processes*, however, are still scarcely developed; most often only by a small number of university-led teams. Such patient care management systems are highly complex and pose many challenges: they require availability of encoded data coming from different sources, flexibility in deviating from the encoded process at the discretion of the physician user, and may involve a team of clinical users that together take care of a patient in a coordinated way.

The recent trend towards healthcare networks and integrated care even increases the need to effectively support interdisciplinary cooperation along with the patient treatment process. Recent studies discussing the preventability of adverse events in medicine recommend the use of information technology, since insufficient communication and missing information turned

out to be among the major factors contributing to adverse events. Yet, there is still a discrepancy between the potential and the actual usage of IT in healthcare.

The ProHealth 2009 workshop focused on IT support of high-quality healthcare processes. IT addressed topics included the modeling of healthcare processes, process-oriented system architectures in healthcare, workflow management in healthcare, IT support for guideline implementation and medical decision support, flexibility in healthcare processes, process interoperability in healthcare and healthcare standards, clinical semantics of healthcare processes, healthcare process patterns, best practices for design of healthcare processes, healthcare process validation, verification, and evaluation.

The workshop received 21 papers from Germany (6), The Netherlands (3), Austria (2), Norway (2), The United States (2), Canada (1), Denmark (1), Israel (1), Italy (1), Portugal (1), Spain (1), and Switzerland (1). Three modalities of papers were allowed: full length papers describing either advanced or finished works, position papers introducing works with preliminary promising results, and tool reports. Papers had to clearly establish their research contribution as well as their relation to healthcare processes. Eleven papers (8 full length papers, 2 position papers, and 1 tool report) were selected and presented in the workshop according to their relevance, quality, and originality.

In his keynote paper "A hybrid multi-layered approach to the integration of Workflow and Clinical Guideline approaches", Prof. Paolo Terenziani from the Informatics Department, University degli Studi di Torino suggests using a hybrid approach in which a computer-interpretable guideline approach is used to focus on "physician-oriented" issues, a Workflow approach is used to cope with the related "business-oriented" issues, and the integration of them is obtained at the underlying semantic level (modeled using Petri Nets), where also general inferential mechanisms operate.

The following four papers focus on utilizing clinical semantics for IT support. The paper entitled "Learning the Context of a Clinical Process" by Johny Ghattas, Mor Peleg, Pnina Soffer and Yaron Denekamp propose an approach which helps with identifying and categorizing the clinical contexts that need to be taken into account within a clinical care process. In their two papers "A Light-Weight System Extension Supporting Document-based Processes in Healthcare" and "alpha-Flow: A Document-based Approach to Inter-Institutional Process Support in Healthcare", Christoph P. Neumann and Richard Lenz target document-based process support in healthcare. The first paper by these authors advocates the application the classic diagnostic-therapeutic cycle as the model for a document-oriented information exchange allows to foster inter-institutional information exchange in healthcare. The α -Flow approach adopts electronic documents as the primary means of information exchange, suggesting a paradigm wherein workflow schemas are represented as documents that can be shared. The paper entitled "An Approach for Managing Clinical Trial Applications using Semantic Information Models" by Hans-Georg Fill and Ilona Reischl presents a modeling approach based on semantic information models that supports the management of clinical trial applications including the generation of user-centric visualizations, performance and compliance analyses and the distribution of the contained knowledge within an organization and to third parties.

The next three papers focus on healthcare process design and quality assessment. The paper entitled "Workflow for Healthcare: A Methodology for Realizing Flexible Medical Treatment Processes" by Nick Russell, Hajo Reijers, Simone Van der Geer and Gertrud Krekel presents a methodology for realizing processes that possess the required degree of flexibility that

makes them suitable for the healthcare domain. To demonstrate the methodology's feasibility, it is applied to the processes that are found in a Dutch outpatient clinic. The paper entitled "BPR Best Practices for the Healthcare Domain" by Mariska Netjes, Ronny Mans, Hajo Reijers and Wil van der Aalst present a list of historically successful improvement tactics, the BPR best practices, and via an analysis of 14 case studies argue that these practices are highly suitable to optimize healthcare processes more efficiently and in a more patient-focused way. In the paper entitled "User-oriented Quality Assessment of IT-supported Healthcare Processes – a Position Paper" Elske Ammenwerth, Ruth Breu and Barbara Paech provides a first collection of process quality indicators that capture the user view of the quality of IT-supported health care processes.

The last three papers focus on verification and testing of healthcare process models. The paper entitled "Verification of Careflow Management Systems with Timed BDI-CTL Logic" by Keith Miller and Wendy MacCaull presents a prototype next-generation multi-threaded model checker to reason about timed processes in careflows sensitive to patient preferences and the goals of the care team using a temporal logic extended with modalities of beliefs, desires and intentions. The paper entitled "Process-Aware Information System Development for the Healthcare Domain - Consistency, Reliability, and Effectiveness" by R.S. Mans, Wil van der Aalst, Nick Russell, Piet Bakker and Arnold Moleman proposes an approach in which the same model is used for specifying, developing, testing and validating the operational performance of a new system. This approach has been applied to a schedule-based workflow system developed for the AMC hospital in Amsterdam. The tool report entitled "An Integrated Collection of Tools for Continuously Improving the Processes by Which Health Care is Delivered: A Tool Report" by Leon Osterweil, Lori Clarke and George Avrunin presents an integrated collection of tools that supports the precise definition, careful analysis, and execution of processes that coordinate the actions of humans, automated devices, and software systems for the delivery of health care. It is intended to support the continuous improvement of health care delivery processes.

We would like to thank the invited speaker as well as the members of the Program Committee and the reviewers for their efforts in selecting the papers (in alphabetical order): Wil van der Aalst, Elske Ammenwerth,

Joseph Barjis, Oliver Bott, Dominic Covvey, Stefan Jablonski, Silvia Miksch, Bela Mutschler, Øystein Nytrø, Silvana Quaglioni, Manfred Reichert, Hajo Reijers, Danielle Sent, Yuval Shahr, Ton Spil, Annette ten Teije, Paolo Terneziani, Lucinea Thom, Samson Tu, Dongwen Wang, and Barbara Weber. They helped us to compile a high-quality program for the ProHealth 2009 workshop. We would also like to acknowledge the splendid support of the local organization and the BPM 2009 Workshop Chairs.

We hope you will find the papers of the ProHealth 2007 workshop interesting and stimulating.