

Chapter 39

Interoperability of Medical Devices and Information Systems

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ABSTRACT

Information and communication technologies have already become an inseparable part of healthcare sector activities. In the chapter, the authors discuss the issues of standardization and interoperability that are crucial for correct interconnection of medical and other devices and information systems. Their previous work in the area has led to the conclusion that successful integration of partial solutions is strongly dependent on the issue of interoperability of medical devices and information systems. It comprises problems of standardization of data acquisition, communication, processing, and storage, and the connected problem: correct data mapping between different ICT applications. They present several examples of partial solutions of communication and data format definition in dedicated areas.

INTRODUCTION

Information and communication technologies have become inevitable and almost inseparable parts of our lives. They have also penetrated many application areas, including medicine. In that way new term “eHealth” has appeared. It represents those activities in healthcare practice that are supported

by electronic processes and communication. The term encompasses rather wide range of systems being at the edge of healthcare and information technology. The systems include electronic health records; telemedicine; consumer health informatics; health knowledge management; medical decision support systems; mHealth (use of mobile devices for different applications in healthcare).

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With boom of smart phones, iPhones and similar devices, mHealth has become an attractive application area. The mobile devices can be used for many different functions in healthcare. Let us mention the most frequently cited: collecting health data; delivery of healthcare information to clinicians, researchers and patients; real-time monitoring of patient vital signs; and direct provision of care (using tools of telemedicine). This technology obviously provides greater access to medical information, larger segments of population in developing countries, improving the capacity of health systems in such countries to provide quality healthcare. Many before mentioned functions of mHealth can contribute to better awareness of care for one own health, teleconsultancy, sending data about one's health to the doctor, informing people e.g. about air pollution and warning them of the situation. Gradually there appear new areas of interest in mHealth: emergency response systems (e.g., road traffic accidents, emergency obstetric care); human resources coordination, management, and supervision (e.g. natural disasters); mobile synchronous (voice) and asynchronous (SMS) telemedicine diagnostic and decision support to remote clinicians; clinician-focused, evidence-based formulary, database and decision support information available at the point-of-care; pharmaceutical supply chain integrity & patient safety systems; clinical care and remote patient monitoring; health extension services; health services monitoring and reporting; training and continuing professional development for health care workers; health promotion and community mobilization. Recently there have appeared additional application areas on the edge of medicine, social care, and technology, namely assistive technologies and ambient assisted living.

Integrating information deriving from different sources and implementing it with knowledge discovery techniques allows medical and social actions to be appropriately performed with reliable information, in order to improve quality of life of patients and caregivers.

Currently the mobile technologies, sensors and other devices enable collecting vast amount of data of individuals. This multi-parametric data may include physiological measurements, genetic data, medical images, laboratory examinations, and other measurements related to a person's activity, lifestyle and surrounding environment. There will be increased demand on processing and interpreting such data for accurate alerting and signalling of risks and for supporting healthcare professionals in their decision-making, informing family members, and the person himself/herself.

Recent development in ICT (Bernstein, 2009; Kaplan, 2005) shows that it is almost impossible to design and implement a complex system as fixed to certain hardware, operating system, and infrastructure. Thus it is necessary to develop such architectures that will be easily extensible and modifiable. For easy extensibility the basic requirement is to understand data exchanged between individual parts of the system. That means not only to recognize data syntax, but also semantic content of the data.

The following section describes technological trends towards mobile devices, including devices measuring physiological parameters; broadband communication; advanced sensor technology; and software development utilizing distributed approach. Next section is focused on the issue of electronic health record and approaches to its standardization. Then we present a brief overview of standards and recommendations for interconnection of medical devices and health care information systems. The conclusion summarizes the chapter and suggests briefly future directions.

TECHNOLOGICAL TRENDS

The technological development in recent decades has been advancing very fast and thus bringing new challenges especially for data transmission and processing.

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