Preface

Healthcare needs have changed quite dramatically. Individuals are living longer, and subsequently, the aging population translates into an exponential growth in the prevalence of chronic diseases. In addition, today’s complex health system cannot consistently deliver today’s science and technology. Moreover, it is less prepared to respond to the tremendous advances that will come in the near future.

Overall, healthcare delivery is overly complicated, lacks coordination, wastes resources, leads to excessive loss of information, and exposes patients to accidental injury due to medical care or from medical error. The National Patient Safety Agency describes patient safety as the process by which an organization makes patient care safer. This should involve risk assessment, identification and management of patient related risk, reporting and analysis of incidents, and the capacity to follow up and learn from them.

E-health holds enormous potential for transforming the safety aspect of healthcare by preventing errors and adverse events, facilitating a rapid response after an adverse event has occurred, and by tracking and providing feedback about adverse events.

Recent developments in e-health include the implementation of electronic health records, decision support systems, and computerized physician order entry systems. Although these technologies directly affect patient safety, e-health inquires emerging scientific fields, which might have a significant impact on patient safety. An incomprehensive list might include:

- Biobanking is an emerging discipline, which follows the continuing expansion of new techniques and scientific goals. Overall, it constitutes a device, which facilitates the understanding of the genetic basis of disease and holds taxonomic strains.
- The development of biochips is a considerable thrust of the rapidly growing biotechnology industry, which encompasses a diverse range of research efforts. Advances in genomics, proteomics, and pharmaceuticals introduce new methods for unraveling the complex biochemical processes inside cells. At the same time, the field of microminiaturization enables biotechnologists to start packing their bulky sensing tools.
- Data mining is the process of extracting patterns from data. It is rarely applied to healthcare, although it can facilitate the understanding of patient healthcare preferences. However, as we gather more data, data mining is becoming an increasingly indispensable tool in mining a wide selection of health records). Moreover, we might complement it with semantics-based reasoning in the management of medicines. Finally, data mining can support quality assurance, simplify the automation of data retrieval, facilitate physician quality improvement, and accurately capture patient outcomes if combined with simulation.
- Disease modeling, the mathematical representation of a clinical condition, summarizes the knowledge of disease epidemiology, and requires computational modeling. Despite ongoing efforts, there are complex issues regarding the use of computational modeling. Therefore, model selection and hierarchical modeling is a high priority.
Technology development has played a vital role in structural genomics. Nowadays, we can quantify the difficulties of determining a pattern of a single protein. Moreover, the systems approach, which the post-genomics follow, interprets into a greater responsibility for artificial intelligence and robotics. Overall, many disciplines turn on the issue of automating the different stages in post-genomic research with a view to developing high-dimensional data of high quality.

Molecular Imaging unites molecular biology and in vivo imaging while enabling the visualization of the cellular function and the follow-up of the molecular process. It differs from conventional imaging in that we use biomarkers to image specific reference points. Biomarkers and their surroundings interact chemically altering the image according to molecular changes, which occur within the point of interest. This method is markedly different from previous methods of imaging which typically image differences in qualities. The accomplishment to image sheer molecular changes opens up an impressive number of exciting possibilities for medical attention.

Nanomedicine, the medical practice of nanotechnology, encompasses the use of nanomaterials and nanoelectronic biosensors and seeks to provide a valuable collection of research and tools. New applications in the pharmaceutical industry include advanced drug delivery systems, alternative therapies, and in vivo imaging. Moreover, molecular nanotechnology, a preliminary subfield of nanotechnology, deals with the engineering of molecular assemblers. So far, it is highly speculative seeking to predict what inventions nanotechnology might produce. However, we already know that we will need nanocomputers to lead molecular assemblers and expect nanorobots to join the medical armamentarium.

Ontologies have become a mainstream issue in biomedical research since we can explain biological entities by using annotations. This type of comparability, which we call semantic similarity, assesses the length of connectedness between two entities using annotations similarity. The implementation of semantic similarity to biomedical ontologies is new. Nevertheless, semantic similarity is a valuable tool for the validation of gene clustering results, molecular interactions, and disease gene prioritization.

One of the most promising developments from the study of human genes and proteins is the discovery of potential new drugs. This relies on the identification of proteins associated with a disease, and involves computer software, which uses proteins as targets for new drugs.

Medical simulation bridges the learning divide by representing certain key characteristics of a physical system. Quality improvement, patient safety, and the actual assessment of clinical skills have impelled medical simulation into the clinical arena. Still, there is convincing evidence that simulation training improves provider self-efficacy and effectiveness and increases patient safety.
safe, quality care. The process begins with leadership’s commitment to transform culture and practice coupled with clarity on the role of technology to achieve that end. The fundamental elements that must be addressed and the strategies to achieve sustainable outcomes are based on the nature of the work, the lessons and outcomes of the Elsevier CPM Resource Center International Consortium of over 346 rural, community, and university settings at various levels of EHR implementation. In chapter 4, Monrad Aas explores the potential role for patient safety of a telemedicine network organization with centralization and decentralization taken into consideration. He stresses that network organization is of importance for strengthening of professional communities and competence complementation. In chapter 5, Jan Kalina and Jana Zvárova present decision support systems in medicine, their basic principles and structure. They emphasize that from the point of view of patient safety, the decision support systems can bring new unexpected sources of errors, which must be anticipated at the design, implementation and validation stages. Nevertheless, a safe and easy-to-use system can greatly improve the quality of determining the diagnosis, prognosis and therapy in healthcare. In chapter 6, Castiglioni, Gilardi, and Gallivanone underline that the increase of incidence and prevalence of dementia diseases makes urgent the clinical community to be supported in the difficult diagnostic process of dementia patients. E-health decision support systems, based on innovative algorithms able to extract information from in vivo neuroimaging studies, can make a quite different way to perform neurological diagnosis and enlarge domains and actors involved in the diagnostic process. In chapter 7, Alexandrou & Pardalis present an innovative software infrastructure, which provides an integrated IT environment concerning the totally dynamic composition of health care business processes (Clinical Pathways) during execution time. The software comprises a health care process execution engine, accompanied by a semantic infrastructure (ontology) for reconfiguring the Clinical Pathways. The SEMPATH (SEMantic PA THways) Ontology comprises three main parts: a) the Clinical Pathway part, b) the Business & Finance part, and c) the Quality Assurance part. During the execution of clinical pathways, the system reasons over a set of semantic rules and dynamically selects the next steps of the treatment. A graphical designer interface is implemented for the definition of the rule-set for the Clinical Pathways adaptation in a user-friendly way, alongside with a graphical user interface for the execution of the treatment schemes. In chapter 8, Hing-Yu So advocates that the application of barcode technology can improve safety significantly in many healthcare processes. Details of applying barcodes in transfusion and medication administration are described to illustrate how they can help to reduce errors. In chapter 9, D’Andrea, Ferri, and Grifoni, present an analysis of the use of RFID technologies for three different purposes: (i) collect and access of all patients records; (ii) track the movements of medical equipment (iii) monitor the health of patients, discussing the privacy implications and existing solutions. In chapter 10, Pietro Previtali evaluates a Grid technology (GT) for Archive Solutions in terms of relevant features for Health Care Organizations (HCOs), with particular attention to technical and organizational issues. The method used is a case study approach, applying a mix of random sampling and “snowball” sampling. The research shows that the introduction of grid technologies in HCOs is still premature, although it can lead to some important benefits. In chapter 11, Marshall and Hogan discuss the extent to which simulation is being used to explore facets of patient safety from the design of specific devices that are being used in the context of clinical work, to the broader organizational design of systems. In chapter 12, Dingli, Abela, and D’Ambrogio present PINATA that utilizes pervasive devices to help doctors and nurses to concentrate on the patient. The movement of medical staff and patients is tracked by means of Wi-Fi sensors whilst an automated camera system monitors the interaction of people within their environment. The system operates autonomously in response to particular situations by guiding medical staff towards emergencies in a timely manner and providing them with the information they require on their handheld devices. This assures that patients are
given the best possible attention on a 24/7 basis especially when the medical staff is not nearby. In chapter 13, Spathis, Archondakis, and Karakitsos, acknowledge that human papilloma virus (HPVs) is the leading risk factor of cervical intra-epithelial lesion creation (CIN) and cervical cancer development (CxCa). Many different techniques have been created and utilized in HPV detection and monitoring with a vast amount of them being commercialized and few of them integrated in screening strategies. However, there has been no effort in combining data from all the different techniques and provide efficient patient triaging schemes, since, apart from the obvious increase of patient cost, the amount of data and its interpretation in patient management has been impossible. In chapter 14, Schetinin and Jakaite found that the Markov Chain Monte Carlo (MCMC) integration tends to oversample the areas in which a model parameter space includes Electroencephalogram (EEG) features making a weak contribution to the assessment. This observation motivated them to cure the results of MCMC integration. In chapter 15, Lambrou, Zaravinos, Adamaki and Vlahopoulos affirm that Acute Lymphoblastic Leukaemia (ALL) is the most common neoplasm in children, but the mechanisms underlying leukemogenesis are poorly understood, despite the existence of several theories regarding the mechanics of leukemic cell proliferation. In this context, they review the current knowledge on proliferation dynamics, along with a discussion of the several existing theories on leukemogenesis and their comparison with the theories governing general oncogenesis. Furthermore, they present some “in-house” experimental data that support the view that it is possible to model leukemic cell proliferation and explain how this has been performed in in vitro experiments. In chapter 16, Corrigan, Hederman, Khan, Taweel, Kostopoulou, and Delaney suggest that clinical prediction rules (CPRs) can provide the basis for a formal representation of knowledge. They continue to present the TRANSFoRm project, which provides an ontology driven clinical evidence service to support provision of diagnostic tools, designed to be maintained and updated from electronic sources of research data, to assist primary care clinicians during the patient consultation through delivery of up to date evidence based diagnostic rules. In chapter 17, Anastasius Moumtzoglou argues that the patient safety movement, dealing either with the person or system approach, is only one aspect of patient safety. Risk perception, as a patient safety dimension, comes into play through personalized self-care. As a result, tailored health communication, that is, ‘any combination of information and behavior change strategies, intended to reach one specific person based on information unique to that person, and derived from an individual assessment’, is essential. In chapter 18, Moumtzoglou argues that the patient safety movement, dealing either with the person or system approach, is only one aspect of patient safety. Risk perception, as a patient safety dimension, comes into play through personalized self-care. As a result, tailored health communication, that is, ‘any combination of information and behavior change strategies, intended to reach one specific person based on information unique to that person, and derived from an individual assessment’, is essential. 

Conclusively, “E-health Technologies and Improving Patient Safety: Exploring Organizational Factors” impacts both the field of patient safety and e-health contributing to the better understanding of their interaction. Specifically, the book opens new avenues for understanding uncertainty as a quality dimension, exemplifies medical simulation, barcodes, RFID, disease modelling, and ontologies, suggests risk perception as patient safety dimension, and introduces novel approaches to improve patient safety.

Anastasius Moumtzoglou
P. & A. Kyriakou Children’s Hospital, Greece

Anastasia N. Kastania
Athens University of Economics and Business, Greece