Recent advances in Medicine allow us to live longer and healthier lives. These advances have been made possible through the joint contribution of very different scientific fields. Healthcare is nowadays better understood as a multidisciplinary field, with increasing number of challenges that can be better tackled by joint collaboration of researchers with different scientific backgrounds.

The challenges that Healthcare is facing have not only to do with the ability of providing better services to all (treatments, preventive medicine, better diagnosis tools), with an increased focus on improved personalized treatment options, but also with the need to tackle an increased pressure felt by Healthcare systems: increased number of patients, some of them requiring expensive treatments, with a consequent increase in the workload for health institutions that most of the times have to deal with important budget restrictions.

This special issue was motivated by the XXXI Euro Mini Conference on Improving Healthcare: new challenges, new approaches, held in Coimbra, Portugal, from March 30 to April 1st, 2015. The conference was able to convene contributions from Operations Research, Medical Physics, Bio-informatics, Health Economy, among others, and promoted the exchange of research experiences and stimulate discussion on methods and applications in the area of Healthcare.

The conference included more than 60 presentations covering several problems arising in the Healthcare sector, as well as the methodological approaches used to tackle those problems. Some areas that were covered were healthcare planning, healthcare logistics and scheduling, data mining in healthcare and contributions from healthcare informatics, among many others. Keynote presentations by 4 distinguished researchers (Prof. Alexandre Quintanilha, University of Porto, Portugal; Prof. Ben Heijmen, Erasmus University, Roterdam, The Netherlands; Prof. David Craft, Harvard Medical School, EUA, and Prof. Sally Braislford, University of Southampton, United Kingdom) contributed to the success of the conference.

The papers in this special issue highlight some of the results from the conference. Being this an open call, additional research contributions to the healthcare sector that were not presented at the conference are also included. The high scientific quality of this special issue would never be possible without the valuable contributions of the authors. Furthermore, in that regard we also have to sincerely acknowledge the referees involved in the reviewing process for timely and comprehensive reviews.

The issue starts with a systematic review on the use of queuing theory on emergency department (ED) operations, by Hu, Barnes and Gold. The authors do also compare the approach with simulation methodologies and identify some challenges in the area. The authors present a

review of 48 articles published since 1970, and notice the increasing interest this topic has raised in the research community, especially in the more recent years. That is possibly due to the overwhelming challenges that increased demand generate in emergency department services. Important paths for future research are also delineated.

Montecinos et al develop a forecasting approach for estimation of patients' consultation and waiting times in "Walk-in clinics" - clinics that provide healthcare services with no appointment, and that have to consider both the arrival time of the patient and the severity of the case to determine the order of attendance of patients. Their approach uses a simplified Particle Filter and Finite Cluster Mixtures in a collaborative way, allowing the use of both historic and incoming data. The methodology is further explored in a case study.

An accurate prediction of the length of stay of patients in hospitals after surgery is vital for effectively scheduling and assigning human and material resources. The paper by Chuang, Hu and Lu, addresses such problem. The authors used supervised learning techniques to develop a prediction model for prolonged length of stay, based in almost 900 cases. A distinguishing feature of the presented work is the fact that the prediction is done before the patient goes into surgery.

Resource management is also addressed by Landa et al. The authors consider a bed management problem, taking into account both emergency and elective patients, within a multiobjective approach. Bed capacity planning and management is a crucial matter that needs to guarantee the best possible use of resources in order to improve patients well being. The compromises that exist between average patient waiting time, number of patients waiting to be admitted, number of rescheduling patients and patients' misallocations are explicitly considered in this paper. A simulation model is developed and applied to a case study.

The logistics associated with hospital internal courier service are the subject of the paper by Rais et al. A decision support system able to help a hospital decide how the internal courier service should be organized has been developed and is in place in a Portuguese hospital. The developed system is compared with the solution previously used by the hospital, showing impressive improvements in performance and efficiency.

Longaray et al. focus on the evaluation of the performance of the internal supply chain processes in a hospital in Brazil. To reach that end, the authors developed an aggregation additive model, that involved three clusters previously identified through decision makers judgement - infrastructure, materials and people – and several sub-criteria (Elementary Points of View – EPV). The resulting tool allows managers to measure logistics performance in the hospital context and to identify more easily activities requiring greater attention and improvement.

Rabbania, Zhalechiana and Farshbaf-Geranmayeha address another important healthcare logistics problem: hospital evacuation planning under uncertainty. Two objective functions are simultaneously considered in the multiperiod model developed: minimization of total evacuation time and minimization of the total weighted number of patients yet to be evacuated in each time period. Evacuation of hospitals has to consider several specific features that are usually not present in other evacuation planning problems, like the type of care needed by each patient that will determine the type of resources that will have to be assigned. The authors used Mixed Integer Linear Programming, aggregating the two objectives into a single one, to solve small problem instances. For larger instances, two metaheuristics were implemented – Genetic Algorithms and an Imperialist Competitive Algorithm.

A final contribution to logistic problems in healthcare is given by Elalouf, Tsadikovich and Hovav. They optimize the blood sample collection process, by defining the optimal number of vehicles involved and the best scheduling for the pickup procedures in order to guarantee that both time and quality constraints are fulfilled. The authors develop a mixed integer programming problem and propose a heuristic procedure to calculate near optimal solutions.

Besides the problem discussed in the previous work, another very important and challenging problem is that of blood inventory management, due to its perishability. Nigel et al. consider in an explicit way the volatility of blood inventories that can arise from stochastic supply and demand, perishability and blood issuing policies. The authors state that volatility can be a consequence of the logistics system in itself, even in the absence of stochastic demand and supply. A system dynamics model of blood inventory was developed and strategies to mitigate volatility are devised.

One well known application of optimization models in Healthcare is in the optimization of radiotherapy treatments planning. Cabrera et al. study the beam angle optimization problem (deciding which are the best radiation incidence directions) in intensity modulated radiation therapy, considering explicitly the inherently multiobjective characteristics of the problem – to irradiate the tumor according to the medical prescription and to avoid surrounding healthy tissue. The authors use a two-phase strategy to generate a set of non-dominated solutions: in the first phase they use Local Search to obtain a set of locally optimal beam angle configurations (BACs), for a single objective problem, and an exact non-linear programming algorithm to calculate the optimal dose distribution for each BAC. Departing from the solutions obtained in the first phase, in the second phase, epsilon-constrained based methods are used to solve the multiobjective problem.

Rocha, Costa and Fernandes propose a tumor growth multiobjective optimal control model that considers chemo-, immuno- and radiotherapy treatments. The aim is to find treatment protocols that minimize both the average number of tumor cells on a given time interval, the therapeutic immuno-injection and the chemo-drug dose administration. Near-optimal solutions are found with a variant of NSGA-II.

Epidemic control is also covered in this volume, with the work by Picinni, Robledo and Romero, The authors present a problem, named "Node Immunization Problem" (NIP) that aims at choosing the node immunization set that minimizes the expected number of deaths in case of an epidemic event, constrained by a maximum budget. The work focus on the extreme case of the NIP, that arises in highly virulent environments. For this case, they develop a GRASP with path-relinking and compare it with a greedy heuristic.

Smith et al. study the location problem of deciding how many diagnostic equipment for HIV/AIDS in laboratories should be located across South Africa, and where to sit them. The equipment should be placed close to health facilities with high demand for specific medical tests and service in hard-to-reach areas should also be recommended. A secondary objective was to reduce travel times from facilities to laboratories (equipment). To tackle the problem, the authors developed a heuristic that starts by doing a geographical clustering of health facilities. This heuristic was employed to find areas of high demand for those tests. Then, a modified set covering algorithm was used to find the lowest number of laboratories needed.

Healthcare resource location/allocation is also addressed by Mousazadeh et al. The work is motivated by a real decision problem faced in Iran on the location and capacity of health service providers, allocation of patients to those facilities and design of the referral system from primary health centers to regional health centers, and from regional health centers to specialty hospitals or district health centers. The aim is to find the most cost-efficient configuration for the health service network, while minimizing the total transportation time from patient zones to the different health centers.

Oliveira, Lopes and Costa describe a real-world participatory process of building a Value Risk Matrix for an occupational health and safety unit. To structure the risk impact dimensions, soft mapping tools are used. The MACBETH-Choquet procedure is used to model interdependent impacts. A system of rules to assess subjective probability of risk is also developed: first, the Decision Makers select a subset of reference risk sources; then, a subjective probability scale is constructed using MACBETH method probability assessment protocol; finally, this probability scale is taken as a reference within a system of rules to elicit a subjective probability for each risk event.

Allocation of budget to clinical and translational research projects at Penn State University is discussed by Munoz, Nembhard and Camargo. They define a goal programming model that considers four critical goals; promotion of multidisciplinarity, training of the new generation of investigators, potential benefits of the proposals, and level of risk.

The diversity of topics that was possible to gather in this special issue would not be possible if Healthcare related problems were not challenging relevant research topics both for the Operations Research scientific community and the Health system. However, most of these problems will only be properly addressed if multidisciplinarity of the research teams is fostered. Now, more than ever, it is important to gather researchers from different scientific backgrounds and to provide them with forums in which discussions can take place and experiences can be shared. In that sense, we believe that the XXXI Euro Mini Conference on Improving Healthcare: new challenges, new approaches, is a good example of initiatives that can and should be taken for better answering the myriad of problems in this area that request for additional thorough research.

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