Modelling a tool for evaluation of innovative therapies

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Abstract and Objective

Health economics are often related to the evaluation of health centres or the cost of innovative treatments, their reimbursement and effectiveness. In this paper we suggest an original model to evaluate a radiotherapy hospital network. Our study is based on informatics modelling and simulation. Its aim is to create a prototype for medical and economic evaluation. We suggest some hypothesis in order to evaluate the recruited population for each centre. Our design takes into account the characteristics of the patient, the description of the centre and the competition between health centres. The economic evaluation includes the cost description of a whole centre: construction investment and functioning. The final goal of our prototype is to compare different situations of recruitment and multiple health politics, referring real situations.

Keywords:

Simulation, Design, Radiotherapy, Evaluation

Methods

In order to design the prototype we use data coming from multiple sources such as geography, demography and epidemiology. Moreover we use medicine data for diseases description ant their treatments, and economical data for describing investment and functioning costs for the centre. On order to interpret correctly this huge volume of information, we designed a knowledge dictionary, as an ontology model with specific grammar and representation. Thus we guarantee a safe transfer of the information between different parts of the global prototype, and we can verify data included in the study.

The most important model using the ontology is the recruitment model. Its purpose is to spread out the population between radiotherapy centres. In addition we built it together with medical experts, thus we are able to assure its plausibility. Parameters coming from the incidence of each indication and statistic methods allow us to create a population for the simulation process. Each patient is characterized by a couple of indication/protocol. We use the geographical position of both patient and centre, to create an attractivity coefficient, which includes the priority level and the therapeutic gain of an indication. This parameter represents the will and the possibility of a patient to go to a health complex. We assume that all health centres are in competition regarding population recruitment. This situation appears when two centres have the same attractivity for one patient. According to the disease and the treatment a list of centres is suggested to the patient, who can choose one. On the other hand each health centre can apply its own health politics.

The recruitment model is completed by a scheduling model, which depends only on the recruitment. This model plans the treatment of the patient into the hospital planning, and we assume that all the material and staff are available. Currently we use a simple model based on the working time of the centre. We will design a more complete one after the validation phase. This model is based on a heuristic maximizing the number of treated patients.

The aim of the cost model is to evaluate the amount of investment for construction and functioning of a new or an existing centre. We use economical methods like the Activity Based Costing, which allocates a cost per activity and product. This model is related to the recruitment model and the scheduling model and evaluates the benefits of innovative facilities.

Results

We designed a prototype based on the models described above. These models are interchangeable, given that the links between them are respected. Moreover the used ontology is independent from any platform, thus reusable. Every model can work separately if its own inputs are respected. The recruitment model is based on an existing model tested for handrontherapy context. For comparison, we add flexible description for medical politics, the presentation of the patient and the scheduling model. Furthermore we can compare the theoretical recruitment with a recruitment of an existing centre.

Conclusion

We designed a model capable of evaluating the position of a radiotherapy centre using innovative facilities. Our prototype could be used as a decision making tool for new innovative facilities, allowing to test different scenarios with respect to staff or treatment capacity as well as health politics.