Lievens Yolande (Catholic University Leuven, 2002): ***Cost and economic evaluation of radiotherapy. Activity-based costing and modelling techniques.***

Summary
The rising technological evolution and demand for health care together with budgetary restrictions have resulted in an increasing interest in the economic aspects of medical interventions. This has led to the recognition of the need for accurate cost data of the treatments we deliver, be it for departmental managerial purposes, for economic evaluations or for reimbursement setting. Further research in this field of medicine is of prime importance to support long-term health care policy planning. In the present thesis, some economic issues of radiotherapy departments and their treatments have been analysed.

Part 1: Activity-based costing in radiotherapy
Accurate data on the cost of radiotherapy activities and products are scarce. Activity-Based Costing is a refined cost-accounting technique that calculates product costs by allocating resource costs on the basis of activity consumption. Its potential in the field of radiotherapy was demonstrated by the development of an ABC model for the Leuven radiotherapy department, which was found to be feasible and yield *accurate cost* estimates.
Despite the high cost of equipment, wage costs were found to be the most important cost component, consuming up to 60% of the total costs. Hence, daily radiotherapy delivery, a highly labour-intensive activity consuming the largest proportion of machine (and thus personnel) time, is the most costly of all radiotherapy activities. As a consequence of this, the number of fractions and the treatment time per fraction are the most important parameters affecting the ultimate product cost.
These findings should be recognised when evaluating new developments in radiotherapy, such as hyperfractionation, conformal and intensity modulated radiotherapy, which, besides requiring more complex treatment preparation, also require more treatment time, and thus translate in higher costs. Whether doing the investment in this additional equipment is worthwhile, should be the object of economic evaluations.

Part 2: Economic evaluations of radiotherapy
Due to the fast evolution of technology and tightening of the budgets, it is no longer possible to deliver all technologically feasible treatments to all potential beneficiaries. Choices have become unavoidable. Whereas new therapeutic strategies were classically evaluated on the basis of feasibility, clinical effectiveness and safety, more recently, economic considerations have been introduced. Central in *economic evaluations* is the relationship between the costs of medical interventions and their outcomes. Accurate data on both, ideally over a sufficiently long time frame, are therefore mandatory. Since it is frequently impossible to obtain all these data from randomised clinical trials, *decision analytic techniques*, especially Markov models, are often used instead.
Based on this methodology, two new radiotherapy treatment strategies have been analysed. The models were built on literature data on effectiveness and on cost data (predominantly) obtained through the ABC program. The immediate and delayed costs (from a societal viewpoint) and effects of both treatments, compared to a standard alternative, were evaluated.
The analysis of CHART in non-small cell lung cancer demonstrated that this treatment has a cost-effectiveness that compares well with that of other NSCLC therapies reported in literature. The ex ante cost-effectiveness evaluation of the internal mammary and medial supraclavicular lymph node chain irradiation, a treatment currently under investigation in a large multicenter EORTC study, found IM-MS irradiation not only to be more effective, but also less costly from a long-term societal perspective.
Based on the assumptions taken in the models, it can therefore be concluded that these treatments should be denied to patients neither on clinical nor on economic grounds. Nevertheless, multiple barriers have been described acting against the implementation of literature evidence in daily practice.
The way in which financial and economic aspects may act against the implementation of evidence-based literature data has been analysed in the last section of this thesis. Although literature evidence converges towards the use of single fractions for the irradiation of metastatic bone pain, practice surveys have demonstrated that this schedule remains infrequently used. It was shown that the incentives imbedded in *reimbursement* may affect the treatment choice and that the recent change in Belgian radiotherapy reimbursement supports the use of single fractions in antalgic radiotherapy.