New evidence based regimens and novel high precision technology have reinforced the important role of radiotherapy in the management of cancer. Current data estimate that more than 50% of all cancer patients would benefit from radiotherapy during the course of their disease. Within recent years, the radiotherapy community has become more than conscious of the ever-increasing necessity to come up with objective data to endorse the crucial role and position of radiotherapy within the rapidly changing global oncology landscape. In an era of ever expanding health care costs, proven safety and effectiveness is not sufficient anymore to obtain funding; objective data about cost and cost-effectiveness are nowadays additionally requested.

It is in this context that ESTRO is launching the HERO-project (Health Economics in Radiation Oncology), with the overall aim to develop a knowledge base and a model for health economic evaluation of radiation treatments at the European level. To accomplish these objectives, the HERO project will address needs, accessibility, cost and cost-effectiveness of radiotherapy. The results will raise the profile of radiotherapy in the European cancer management context and help countries prioritizing radiotherapy as a highly cost-effective treatment strategy.

This article describes the different steps and aims within the HERO-project, starting from evidence on the role of radiotherapy within the global oncology landscape and highlighting weaknesses that may undermine this position.
understanding the variability in care

Firstly, it can be questioned to what extent clinicians (are willing to) adhere to clinical guidelines, of which a successful implementation is expected to improve quality of care by decreasing inappropriate variation and promoting the utilization of effective therapeutic advances into everyday practice [17].

Unfortunately, patterns of care studies seem to demonstrate that neither widespread availability of level I literature evidence, nor existing guidelines, are sufficient preconditions to homogenize patient care in radiotherapy. One striking example is the treatment of uncomplicated metastatic bone pain, where multiple randomized trials have proven the equivalence – in terms of pain control and survival – of single fractions compared to fractionated radiotherapy regimens. Regardless, analyses performed in different parts of the world have all observed a large variation in practice, with an overall predominance of fractionated regimens [18–20]. Similarly, the development of guidelines for (3D conformal) radiotherapy in lung cancer does not seem to have translated yet into a consistent approach for locally-advanced non-small cell lung cancer [21,22].

Many factors have been described to explain physician’s reluctance to implement changing evidence in their practice [17,23]. The use of different radiotherapy schemes may in part be explained by clinical arguments, such as the age and perceived prognosis of the individual patient. Moreover, personal characteristics of the physician, dealing with clinical uncertainty and perceived risk, and the prevailing opinion, with an inclination to adhere to departmental policy and past teaching, may play a role as well.

In addition, socio-economic factors are known to affect treatment choice and delivery. Whereas the lack of resources typically stimulates the use of fewer, less complex, less costly and potentially less qualitative treatments, the opposite observation – i.e. the more frequent use of high-tech, costly and potentially inappropriate treatments – is found if resources are plentiful. The analysis on radiotherapy dose fractionation, access and waiting times in different UK countries, for example, correlated lower radiotherapy utilization to the limited availability of radiotherapy staff and services in the different regions [24]. Similarly, the patterns of care studies on lung cancer radiotherapy in Spain and in eastern and central European countries both suggested that variation in practice may decrease with proper public health-care planning of resources [21,22]. Hence the necessity to optimize radiotherapy accessibility and to adapt, as much as reasonably achievable, the provision of radiotherapy facilities to the estimated needs of the individual countries and regions.

Once the staffing and infrastructure requirements have been identified, actions should be taken to overcome the potentially unmet needs. As it may take many years to accomplish, a first important action is to stimulate training programs for the formation of skilled personnel. Besides, the shortage in terms of infrastructure, equipment as well as the actual number of radiotherapy departments should be overcome. Obviously, this may be equally time consuming and moreover highly dependent of the financial determinants of the region or country. A relationship between the number and type of equipment and the gross income of the country has been described in different parts of Europe [22,25].

Last but not least, it should be recognized that money does not only drive practice at the macro level – i.e. through capital investment on a national basis – but that it is a powerful incentive at the micro level of medical decision-making as well [26]. Physicians tend to adapt their clinical behavior to the reimbursement offered, more or less independently from the available resources [27]. The different practice surveys on bone metastases indeed suggested that the antalgic radiotherapy schedules in vogue in different countries were closely linked with the prevailing reimbursement system: protracted schedules when fee-for-service dominates reimbursement compared to hypofractionation and single fractions in budget and/or case payment systems [19,28].

These observations highlight the complex interplay between the different factors that may influence optimal radiotherapy utilization and delivery, as well as at the level of the patient–physician interaction, as from a more general, societal perspective.

radiotherapy staffing and infrastructure

The first real attempt to arrive at estimates for the appropriate level of radiotherapy infrastructure and staffing in Europe was performed by the QUARTS-project (Radiation Therapy for Cancer: QUAnification of RadioTherapy Infrastructure and Staffing Needs). This project, supported by a European Union (EU) grant, had the primary aim to provide health care planners and policy makers with objective data regarding radiotherapy requirements, by combining epidemiology data and evidence-based radiotherapy indications with information about resource availability [25,29]. Results were analyzed in function of the gross domestic product (GDP) per capita: countries with GDP/capita > US$10,000 were defined as high resource countries, while medium and low resource countries as those having a GDP/capita between US$3,000–US$10,000 and lower than US$3,000, respectively. As a first step, guidelines for the number of equipment and/or personnel were questioned in all 44 European countries [29]. Guidelines were available in 17 countries (41.5% of the respondents). Whereas there was a wide range in recommended personnel (one radiation oncologist per 150–400 patients treated annually; mean 250), this was not related to the type of countries. In contrast, the recommendations for the equipment (number of accelerators, linacs as well as Cobalt machines) required per number of inhabitants was determined by national income (i.e. an average of 1/183,000, 1/284,000 and 1/500,000 in res. high, medium and low resource countries). As personnel costs are most frequently in line with the average income in a country, they may not have a major impact on the number of professionals. The price of machines, however, is more independent of national prosperity. High equipment costs may therefore obstruct optimal expansion of the infrastructure in low-income countries, further translating in more restrictive guidelines. Based on the existing guidelines it was suggested that one radiation oncologist should be available per 200–250 patients annually and that one linear accelerator should serve 450 patients. But obviously, such crude guidelines may not be adequate for wide application in different (European) countries, all being characterized by specific demographics and cancer incidence. Hence, further refinement accounting for the population structure, epidemiology and radiotherapy utilization, as well as for evolving technology and treatment strategies, seemed essential. This was the rationale for developing a model, described in the second part of the QUARTS analysis [25], where the best available evidence on radiotherapy indications in 23 main cancer types was combined with epidemiological data from all 25 EU countries at that time and with published benchmarks for accelerator throughput. From this analysis, it became clear that the large variation in crude cancer incidence observed within the analyzed EU countries indeed translates into a similarly large variation in the estimated number of required linear accelerators per million inhabitants (between 4.0 and 8.1 linacs/million), hovering around a European average of 5.9. These data were subsequently compared with the national guidelines and the existent availability of infrastructure, revealing major inequalities among the analyzed EU countries and large discrepancies between optimal and available infrastructure in some. The largest gap between the actual situation and the calculated
optimum was observed in eastern European countries and in the United Kingdom, supporting the expansion of radiotherapy capacity in these countries, as it may have implications for radiotherapy utilization and practice, as described earlier [22,24]. On the other end of the spectrum, Sweden, France and Belgium were countries where the availability of megavoltage units exceeded 90% of the calculated need.

The ESTRO HERO project

Although data as presented in QUARTS are indispensable to guide actions toward optimal radiotherapy provision within the more global context of national health care plans, they clearly only represent a snapshot in time. Not only do they need to be regularly corrected for the changing cancer incidence and demographics (not in the least in relation to the aging of our Western population), they should equally take the evolving evidence on radiotherapy indications and utilization into account, in view of correctly forecasting future radiotherapy resource needs. Moreover, the radiotherapy community – and more specifically the European Society for Radiotherapy and Oncology (ESTRO) – has become more than conscious of the ever-increasing necessity to come up with objective data to endorse the crucial role and position of radiation oncology within the rapidly changing global oncology landscape. In an era of ever expanding health care costs, proven safety and effectiveness is not sufficient anymore to obtain funding, objective data about cost and cost-effectiveness are nowadays additionally requested.

It is in this context that the ESTRO is launching the HERO-project (Health Economics in Radiation Oncology), with the overall aim to develop a knowledge base and a model for health economic evaluation of radiation treatments at the European level. To accomplish these objectives, the HERO project will address five different dimensions.

The need for radiotherapy will be assessed by defining the optimum radiotherapy utilization in Europe derived from cancer incidence and evidence-based guidelines. Resources required to deliver this defined optimum level of care will be determined. Provision and accessibility will be addressed by surveying national recommendations on infrastructure and staffing levels, compared with the available resources in European countries and the estimated need, using the QUARTS methodology. In addition, the actual radiotherapy treatment mix delivered within the different countries will be documented.

With the former data on radiotherapy population and resources at hand, a cost-accounting program for radiotherapy will be developed at the European level, using Activity-Based Costing methodology. The generated cost data will subsequently form the basis for economic evaluations, using decision analytic models. As a final step in the HERO project, the identified key figures and cost-effectiveness data will be used for profiling radiotherapy in the global cancer management context and to help countries prioritize the most cost-effective approaches. It should moreover help in the definition of optimal reimbursement strategies in order to tackle the potential discrepancy between the evidence-based need and the radiotherapy resources available in different countries. It is only by investing in this kind of research that the radiotherapy community can demonstrate that radiotherapy truly delivers value for money, even in the context of innovative, more resource demanding, technologies. This will in term hopefully facilitate the interaction with governmental and insurance parties, make us equal partners in health care management, decision-making and budgeting and as a final consequence allow us to deliver high-quality radiotherapy to each individual patient. By highlighting health economic aspects and potential inadequacies across Europe, we hope to strengthen the position of radiation oncology and hence, in a more global sense, lead to improved cancer care.

Conflict of interest

No actual or potential conflicts of interest exist.

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