surgical cosmesis were more likely to develop photographically assessed breast shrinkage (OR 1.54, 95% CI 1.21-1.96; p<0.001), tumour bed induration (OR 1.80, 95% CI 1.43-2.26; p<0.001) and sub-optimal cosmesis (OR 8.15, 95% CI 6.08-10.92; p<0.001) at five years. Conclusions: Improved dose homogeneity with IMRT translates into superior overall cosmesis and reduces the risk of skin telangiectasia at 5 years post RT. These results are practice-changing and should encourage other centres still using 2D standard RT to implement breast IMRT. In addition, surgical cosmesis could be optimised as this also has a significant effect on late breast toxicities.

Discussion: Prognoses of the number and types of radiotherapy treatments allow for an accurate prediction and planning of the required staffing and infrastructure to avoid waiting lists and overcapacity. The expansion of the existing departments instead of the addition of new centers, allows for a more rapid implementation of new techniques and will allow sufficient sub-specialization of the staff. In recent years, the expansion of departments is often realized by establishing ‘satellite centers’, which are an integral part of the main center. Treatment planning is performed at the main site and the staff rotates over the satellite(s) and the main center. Treatment planning is performed at the main site and the staff rotates over the satellite(s) and the main center.

Materials and Methods: Patients undergoing postoperative RT for localized breast cancer treated at our institution between January 1999 and December 2008 were the object of the study. RT consisted of 50 Gy in 5 weeks on the chest wall, in the case of mastectomy, and on residual breast in the case of quadrantectomy or lumpectomy, and eventually on the axilla and supraclavicular nodes. A boost of 10 Gy was administered to the tumor bed of all the conserving surgery treated patients. The clinical data were analyzed with univariate and multivariate analysis considering age (<40, 40-64, >65), nodal status (N+ vs N-), tumor classification (T1 vs T1), grading (G1-2 vs G3), oestrogen and progesterone receptors (ER and PgR), and erb-B2 status. A further classification of patients according to a surrogate approximate genetic signature and recognizing the four subtypes of BC, namely luminal A (ER+ and/or PgR+ and erb-B2), luminal B (ER+ and/or PgR+ and erb-B2 ), HER-2 (ER-, PgR- and erb-B2-), and basal (ER-, PgR- and erb-B2-) was adopted. Freedom from loco-regional relapse (FFLR) was defined as the time from diagnosis to the loco-regional relapse (LR). The 8-year LR rate was estimated by the Kaplan-Meier method.

Results: Seven hundred thirty-three patients with a median age of 53 years (range 27-84) and with a minimum follow up of 12 months entered the study. Chemotherapy, hormonal therapy or both, were administered in 57, 374, and 249 patients, respectively. The median follow up was 84 months (range 12 – 126), with an overall survival of 96%. The 8-year actuarial rate of LR was 3%. Univariate analysis showed a significant relation of LR with age (LR=6.1% for age<40 years, LR=1.6% for 40<age<65, LR=6.5% for age >65), grading (LR=1.7% for G1-2, LR=4.1% for G3), ER status (LR=2.3% for ER- , LR=5.4% for ER+, LR=1.5% for HER2 subtype (LR=2.3% for no-HER2 , LR=8.5% for HER2)). From the multivariate analysis, age (hazard ratio 3.9 for age<65 years and 3.2 for age>60 years compared with 40-65 years and HER2 subtype (hazard risk 3.8) were the only significant factors for LR risk prediction (Fig.1).

Figure 1

Conclusions: Age less than 40 and equal to or more than 65 years and HER-2 subtype are associated with a greater risk of local relapse. These results do not support a different RT management of elderly patients.
Implementation Group (NRIG) was established to implement these recommendations. The NRAG model of radiotherapy demand was seen as overambitious and unrealistic for the Malthus Programme was commissioned to review and update the work. Malthus is an academic initiative to provide adiscrèt event tool for simulation of radiotherapy demand in the U.K. at a local level. Launched in October 2011, the tool provides radiotherapy service managers and healthcare commissioners with a comprehensive tool that can quantify radiotherapy demand at the level of the primary care trust (mean population = 330,000) or cancer network (mean population = 2,300,000). Clinical decision making is encoded into disease specific decision trees, established by a review of current evidence-based practice for radiotherapy. The tool uses curated data feeds from the national cancer intelligence network to provide accurate local population demographic and cancer incidence data. Models for population growth and change in cancer incidence are used to forecast radiotherapy demand through to 2030. The estimate of radiotherapy demand for the U.K. as a whole for 2016 is 55,000 fractions per million, closely similar to that of NRAG. To encourage expansion of radiotherapy there is now a nationally-agreed tariff and the service will be commissioned nationally.

The Radiotherapy Dataset (RTDS) collates information on treatment activity via electronic feeds from all radiotherapy centres in England. Monthly data uploads have been mandatory since April 2009, and data feeds from RTDS are available with a 12 month latency from the Cancer Commissioning Toolkit. These data can be compared to the Malthus model in order to understand radiotherapy provision for the local population. As local data on stage and performance status become available it will be possible to assess the influence of these factors on the uptake of radiotherapy and whether or not they have a significant influence in addition to under-investment.

IMRT delivery has increased from 2% of patients in 2008 to 11% of all patients in 2012. It is expected that IMRT will be offered to the 33% of radically treated patients who would benefit by the end of 2013. A national programme to support IMRT training, implementation, and quality assurance has been established to overcome the barriers including staff shortages, lack of agreed funding for IMRT, and low levels of training in IMRT implementation. The expansion of IGRT will then pave the way to the development of 4D adaptive radiotherapy as envisaged in the NRAG report of 2007.

SP-0206 The European viewpoint: ESTRO-HERO experience
Y. Lievens1, J.M. Borras2, M. Bogusz-Czerniewicz1, M. Coffey4, P. Duncscombe5, D. Hollywood6, C. Gasparotto7, J. Malicki8, B. Slotman9, C. Grau10
1Universitair Ziekenhuis Gent, Department of Radiation Oncology, Gent, Belgium
2Istitut Català d’Oncologia, Department of Epidemiology, Barcelona, Spain
3Great Poland Cancer Centre, Department of Radiation Oncology, Poznan, Poland
4HERO group, None, Dublin, Ireland
5Tom Baker Cancer Centre, Medical Physics, Calgary, Canada
6Trinity College Dublin, Department of Radiation Oncology, Dublin, Ireland
7ESTRO, Education, Brussels, Belgium
8Great Poland Cancer Centre, Medical Physics, Poznan, Poland
9V.U. University Medical Centre, Department of Radiation Oncology, Amsterdam, The Netherlands
10Aarhus University Hospital, Department of Radiation Oncology, Aarhus C, Denmark

Based on detailed evidence-based modeling, radiotherapy has been identified as a necessary component of the oncological treatment in on average 52% of all newly diagnosed cancer patients. Such estimates are important to help forecast radiotherapy resource and personnel needs. But when applied to different countries, such as in the highly variable European context, one should be aware that they are sensitive to the demographic and socio-economic factors in these countries and to changes in incidence, population mix and stage distribution over time.

In the early years 2000, the ESTRO-QUARTS-project used a combination of epidemiology, evidence-based radiotherapy indications and resource use to evaluate the differences in needs amongst 23 European countries. Along with this modelling exercise, it also suggested benchmarks for structured practice and personnel requirements. Although extremely valuable, these data only represented a snapshot in time. To be of practical help for the European countries to support their radiotherapy programmes and infrastructure projection, they do not only need regular update and correction for changes in cancer incidence and demographics, they should also take the evolving evidence on radiotherapy indications, utilisation and complexity into account. Furthermore, there is an urgent need for accurate data on infrastructure and personnel availability, to put the estimated needs into the correct perspective.

Hence, almost a decade later, ESTRO has launched the HERO-project (Health Economics in Radiation Oncology), of which the overall aim is to develop a knowledge base and a model for health economic evaluation of radiation treatments at the European level.

As a first task in the project, a validated and detailed blueprint of the present situation of radiotherapy in Europe is made in terms of cancer incidence, number of centres, equipment and personnel and of reimbursements. Furthermore, a refinement of the QUARTS analysis on the needs is carried out, based on modelling exercises incorporating the most recent evidence-based utilisation estimates of CCORE. Apart from supporting the European countries and national societies within radiotherapy and oncology in their strive for optimal radiotherapy capacity planning, these data will be used to feed nation-based cost-accounting models for radiotherapy. Finally, these data will also form the basis for cost-effectiveness analyses to evaluate the value for money of radiotherapy innovations and of radiotherapy compared to other oncological treatments.

SYMPOSIUM: RETHINKING MARGINS IN THE DAILY-IGRT AND/OR ART CONTEXT

SP-0207 The past, present and future of margins in radiotherapy
M. van Herk1
1The Netherlands Cancer Institute - Antoni van Leeuwenhoek Hospital, Department of Radiation Oncology, Amsterdam, The Netherlands

Because of inevitable uncertainties in RT, margins assure that the prescribed dose is actually absorbed in the target. A major breakthrough in thinking about margins occurred with the appearance of ICRU50, standardizing terminology. Around the same time, random errors, that affect each treatment fraction differently, and systematic errors that affect all fractions in the same way were differentiated. A second breakthrough occurred in the nineties when it was realized that you have to make a trade-off between the risk of underdosing the target that reduces with bigger margins, versus the risk of overdosing normal tissues that increases with bigger margins.

This trade-off is then expressed as the probability of a certain underdose of the target. Using then plausible uncertainty data for the prostate, it appeared that a 90% probability of delivering 95% of the prescribed dose in the target required a then routine 1 cm margin. I.e., these numbers were apparently clinically acceptable and they formed the basis for the (simplified) NCI margin recipe: M = 2.5 SIGMA + 0.7 sigma. Many authors have challenged and refined this publication but it is still being widely used. The equations works well for a wide range of situations and are safe if you adjust the SIGMA and sigma for the number of fractions given.

Then what are the problems with margins? First, they do not take the beam and patient geometry into account. E.g., a high dose is assumed even where the margin overlap an organ at risk, while the probability of the target being in that location during treatment may be very small. Ad-hoc adjustments are therefore often made, but this makes it very difficult to assure robustness or even estimate the level of robustness of the modified plan. Finally, with painted dose distributions, no simple margins recipes exist.

How are we going to deal with these problems? Well there is only one good solution, margins have to go! By incorporating the knowledge about residual uncertainty distributions directly into IMRT planning, reduced dose distributions are sculpted that take the actual shape of the dose distribution and the location of organs at risk into account when generating a ‘margin’. A number of publications have investigated this approach, demonstrating the possibility to develop plans that are just as robust as their margin-based counterparts, but with much lower exposure of the organs at risk. The resulting plans look very sensible, e.g., similar to integrated boost approaches with reduced margins towards organs at risk but with guaranteed robustness. And why is not everybody using this approach if it is cleaner? Better? This is because so far no planning system vendors have refused to invest in this approach. Hopefully this situation will change soon.