and between countries.

2) This variation will relate to patient factors, disease-related factors, and treatment factors.

3) That regional variation in need for radiotherapy for lung cancer predicted by the MALTHUS model will be greater than that seen with a benchmark approach to optimal utilization.

Methods: The MALTHUS model for radiotherapy demand will be utilized in order to investigate factors associated with regional variation in need for radiotherapy for lung cancer patients. MALTHUS decision trees for 23 disease sites have been established. The proximal branches of the tree encodes for cancer site, stage distribution, and treatment modality indication. Distal branches contain detailed information about how radiation is delivered, such as fractionation. MALTHUS takes into account variation in cancer incidence, disease stage, performance status, and co-morbidity. It draws on high-quality cancer incidence data collected from national Cancer Registries and the National Cancer Intelligence Network (NCIN). It simulates demand at local, regional and national levels, and draws comparisons with actual radiotherapy activity from the British National Health Service’s (NHS) Radiotherapy Dataset (RTDS). The resulting data can be used to study the effects of differences in local opinion over best practice, and can assist local oncologists and service managers in developing and assessing business plans.

We will update the British data with direct access to the National Cancer Intelligence Database that, from previous work, has been properly curated for the use of this model. Data will be stratified for age, tumor characteristics, stage distribution, and region subdivided at the county level. The model will then be adapted to the appropriate treatment indications and dose fractionations using national evidence based best practice guidelines. We will quantify the influence of patient-related factors (age, sex, comorbidity, functional status), disease-related factors (cancer incidence, cancer stage), and treatment factors (hypofractionation including usage of SBRT) on regional (NHS Primary Care Trust level) demand for radiotherapy for lung cancer. In univariate analysis, factors will be defined categorically and demand for radiotherapy by variable category will be described. The influence of these factors will be further investigated in univariate sensitivity analysis. The consequences of applying regional extremes in each variable’s distribution on national radiotherapy demand will be considered. For multivariate sensitivity analysis, a Monte Carlo (MC) simulation model will be developed. Confidence intervals from MC simulation will be compared against ranges of proposed evidence-based benchmarks to compare model performance and precision. Potential differences in the influence of key factors influencing demand may exist between countries. As a second phase, we anticipate to adapt the model to the population of lung cancer patients in Ontario for comparison of outcomes. Population-based data from the Ontario Cancer Registry (OCR) will be utilized. This will include data on cancer incidence, and collaborative stage information. Data on age distribution by county from OCR will be used to estimate regional differences in performance status and comorbidity.

Significance: A primary benefit of this model is its potential to elucidate what influences demand for radiotherapy patients. Demand, and by the same token, wait lists, are affected by an increase in the incidence of cancer, by the increase in the referral of patients for radiotherapy, and by an increase in dose fractionation per course of radiotherapy. All of these factors are reflected in the MALTHUS. As the public system has a fixed global budget and lacks the reserve needed to expand capacity quickly in radiotherapy, an accurate prediction of future demand is vital in our situation. Comparing Canadian and British data utilizing MALTHUS should increase generalizability in its projections and may identify national differences in the impact of key factors driving demand. Reliable, well-characterized models are needed, as it can take years in working closely with policy makers in order to influence officials to provide adequate capacity for high-precision radiotherapy.

Radiation therapy has major oncological benefits, and small incremental gain in health system performance can translate into large societal benefits. Health Services Research in its nascent stages in the field of Radiation Therapy, therefore there is a significant amount of knowledge and skills that can be gained by young investigators. Results of this research program will have a direct link to many global institutions. ESTRO and QUARTS are currently exploring optimal infrastructure for radiation therapy around Europe, a project funded by the European Commission. Moreover, this comparative analysis will supplement data utilized for Activity Based Costing and Cost Benefit research that ESMO is currently undertaking.

43  PHASE I-II ON THE USE OF DUAL-ENERGY COMPUTED TOMOGRAPHY (DECT) FOR ASSESSMENT OF DIFFERENTIAL PULMONARY FUNCTION IN RADIOTHERAPY PLANNING

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Purpose: Current lung parenchyma dose reduction strategies do not take into account the relative contribution of different lung regions. The addition of functional information at the time of treatment planning could preferentially save the most functional parts and reduce the risk of toxicity. The purpose of this study was to quantify lung function based on a DECT-derived iodine map in patients treated with radiotherapy for lung cancer, as well as to assess the dosimetric impact of its integration in radiotherapy planning.

Methods and Materials: Patients treated with stereotactic ablative radiotherapy (SABR) for early stage or intensity-modulated radiotherapy (IMRT) for locally advanced lung cancer were prospectively enrolled in this study. A DECT in treatment planning could preferentially save the most functional regions. The purpose of this study was to quantify lung function based on a DECT-derived iodine map in patients treated with radiotherapy for lung cancer, as well as to assess the dosimetric impact of its integration in radiotherapy planning.

Results: Results from 20 consecutive patients, including 16 patients treated with SABR and four patients with IMRT, are presented. Sixty percent had known chronic obstructive pulmonary disease. Median forced expiratory volume in one second was 62.6% of predicted (29-113%) and median diffusing capacity of the lung for carbon monoxide was 56% (39-91%). There was a strong correlation between DECT and SPECT/CT-derived lung function (r = 0.8, p = 0.0001). Mean V5, V20 and mean dose (MLD) to whole lungs (anatomical) versus functional lungs were compared using bilateral paired Student T tests.

Conclusions: DECT-derived iodine map correlates well with SPECT/CT and its integration in treatment planning is associated with significant differences in V5 and mean dose to functional lungs. Future work will focus on selection of patients most likely to benefit from function-sparing IMRT.

44  PREDICTING IQ AND THE RISK OF HEARING LOSS FOLLOWING PROTON VERSUS PHOTON RADIOTHERAPY FOR PEDIATRIC BRAIN TUMOUR PATIENTS

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