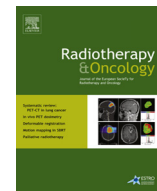




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Original article

How many new cancer patients in Europe will require radiotherapy by 2025? An ESTRO-HERO analysis

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ABSTRACT

Background: The objective of this HERO study was to assess the number of new cancer patients that will require at least one course of radiotherapy by 2025.

Methods: European cancer incidence data by tumor site and country for 2012 and 2025 was extracted from the GLOBOCAN database. The projection of the number of new cases took into account demographic factors (age and size of the population). Population based stages at diagnosis were taken from four European countries. Incidence and stage data were introduced in the Australian Collaboration for Cancer Outcomes Research and Evaluation (CCORE) model.

Results: Among the different tumor sites, the highest expected relative increase by 2025 in treatment courses was prostate cancer (24%) while lymphoma (13%), head and neck (12%) and breast cancer (10%) were below the average. Based on the projected cancer distributions in 2025, a 16% expected increase in the number of radiotherapy treatment courses was estimated. This increase varied across European countries from less than 5% to more than 30%.

Conclusion: With the already existing disparity in radiotherapy resources in mind, the data provided here should act as a leverage point to raise awareness among European health policy makers of the need for investment in radiotherapy.

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The number of newly-diagnosed cancer patients that would require radiotherapy treatment using an evidence-based approach was estimated for all European countries for the year 2012 within the framework of the ESTRO-HERO (Health Economics in Radiation Oncology) project [1]. The estimate was based on optimal utilization of radiation oncology according to the CCORE methodological approach [2], using incidence data for European countries as estimated by the International Agency for Research on Cancer (IARC) [3,4], and combined with data on stage at diagnosis from four population-based cancer registries (The Netherlands, Slovenia, Grater Poland region of Poland, and Belgium) available in the categories required [5].

This estimation provides a useful tool for planning the required equipment and staff needs. One of the critical results was the observed gap between the optimal utilization and the actual use

of radiotherapy, with most countries covering less than 80% of the evidence-based demand for treatment compared with actual use [1]. This evidence could be immediately applied to improve cancer control planning with respect to placing the necessary investments required to cope with the demand of cancer patients.

Long-term planning is required for radiotherapy facilities as well as for the staff needed, due to the significant interval between the time of making decisions for facility investments and training of personnel and the time when they become a clinical reality. A forecast of the anticipated changes in terms of new cancer patients that would need radiotherapy in the short- to medium-term time horizon seems rational, and fits within the objectives of the ESTRO-HERO project.

The aim of this paper is then to assess the number of new cancer patients by tumor site that will require radiotherapy in 2025 as compared to the 2012 data, using the national cancer incidence estimates based on data from the population-based cancer registries available in each European country together with projections carried out by IARC in GLOBOCAN [6].

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Materials and methods

European country-specific cancer incidence by tumor type was extracted from the GLOBOCAN database [4] for the year 2012. The detailed description of the data and the methods used to compute these estimates is given elsewhere [3]. To summarize, statistical models were developed to predict incidence rates for the year 2012 from recent trends, wherever possible. The country, sex, and site estimated incidence rates in 2012 were then applied to the corresponding population estimates to obtain the estimated numbers of new cancers in each European country in 2012. Projections for the year 2025 were computed using the facility available at the GLOBOCAN website [4]. The projected numbers of new cancer cases have been derived by applying the age-specific incidence rates estimated for 2012 to the corresponding forecast population in 2025. Therefore, the projected incident cases for 2025 took into account the demographic changes (age structure and size), but not the potential impact of the changes in risk factors.

Tumor sites included in the analysis were as follows: bladder, brain, breast, cervix, colon, gallbladder, head and neck (lip, oral cavity, larynx, oropharynx, hypopharynx and nasopharynx), kidney, leukemia, lung, lymphoma (including Hodgkin and non-Hodgkin lymphoma), melanoma, multiple myeloma, esophagus, ovary, pancreas, prostate, rectum, stomach, testis and corpus uteri). It has been necessary to adapt the categories provided by GLOBOCAN to fulfill the requirements of the radiotherapy evidence-based Optimal Utilization Proportion (OUP) [2]. “Colon and rectum” cancer was partitioned into colon and rectal cancers, “lip and oral cavity” into lip and oral cavity and the category “other pharynx” into oropharynx and hypopharynx. In order to do this, we extracted data from population-based cancer registries available in the last volume of Cancer Incidence in Five Continents [7] for as many European countries as possible and computed proportions of each individual category. When no data were available in a particular country (such as Albania, Macedonia or Luxembourg), the data from a neighboring country was used. The same proportions were used in the 2012 and 2025 estimates.

OUP of radiotherapy by tumor site was obtained from the Australian Collaboration for Cancer Outcomes Research and Evaluation (CCORE) review [2], which provided radiotherapy indications for all tumor sites according to the relevant evidence-based clinical guidelines by tumor site and stage at diagnosis, updated to 2012. The stage at diagnosis originally used in the CCORE was from the Australian cancer registry. Four different European cancer registries provided data fitted to the CCORE decision trees structure (Slovenia, Greater Poland region of Poland, Belgium and The Netherlands) in order to estimate the OUP using a range of stage at diagnosis from distinct European countries. The methodological details of this analysis have been provided elsewhere [5]. The same OUPs were used in the 2012 and 2025 estimates. For the correct interpretation of the OUPs it is necessary to know that each patient is counted only once, even if he or she subsequently required further treatment for the particular cancer. Brachytherapy treatments were not considered.

Results

About 4 million new cancer patients are predicted in 2025 in Europe based on demographic changes. This represents a 15.9% increase in the absolute number of cases compared to the 3.4 million diagnosed in 2012, assuming overall cancer rates remain unchanged (Table 1). Using the lowest OUP estimated for each country, the absolute number of patients that would have an indication for radiotherapy at least once during the course of the disease would increase from 1,700,000 patients approximately in 2012 to 2,000,000 in 2025. This represents a 16.1% increase over the entire period.

This increase in the number of expected cases is not distributed evenly across European countries (Table 1 and Fig. 1). Eastern European countries exhibited, broadly speaking, the lowest percentile increases, with Bulgaria, Ukraine, Latvia and Lithuania expecting decreases in the number of new cancer cases, while the incidence burden in many of the rest of Eastern countries is predicted to increase by less than 10%. The exceptions were Poland, the Czech Republic and Slovakia with increases of around 20% or above. However, when the focus is on the absolute in numbers, as shown in Fig. 2, it is clear that the greater increases are estimated in the most densely populated countries.

South-Eastern European countries showed a diversity of estimated changes in the number of patients, from a relative decrease in Bulgaria (−0.8%) to an increase of 33.4% in Albania. The highest relative increases were observed among small countries with no clear geographic pattern (Iceland, Ireland and Cyprus) with increases above 35%, while the incidence rises in more populated countries such as The Netherlands, Switzerland and Norway were between 25% and 31%. The countries of Western Europe, including France, Germany, Italy, Spain or the UK, with the highest volume of population, exhibited increases in the number of new cases from 2012 to 2025 by between 15% and 25%.

Relative changes by tumor site and for all countries combined are presented in Table 2. It is worth noting that prostate cancer produced the highest increase over the period considered with a 24.4% rise followed by bladder cancer and multiple myeloma, while female breast cancer, lymphomas and head and neck cancer were below average. Importantly, cervical cancer only increased by 1.1% while the numbers of patients with a radiotherapy indication for cancer of the testis declined.

The tumors that make up the highest percentage of patients in a radiotherapy department, namely breast, rectum, head and neck, lung and prostate cancers are shown in Table 3 for each European country with their absolute and relative increase. Some relative increases are noteworthy and deserve close analysis at national level. For instance, countries such as Spain, The Netherlands or the Czech Republic show an increase higher than 25% for rectal cancer patients with a radiotherapy indication, while Belgium, UK or Denmark have an estimated increase above 20%. Also, the estimated increase for prostate or lung cancer is very important in many western European countries, higher than 20%; while the observed increases for breast cancer patients are moderate in comparison.

Fig. 3 provides a visual representation of the cancer types with the highest absolute number of radiotherapy indications, projected for the 2025. Interestingly, in several countries bladder cancer ranks among the most frequent cases according to the evidence-based indications, due to its high incidence in these countries. A similar observation can be made for lymphoma (estimates by country for all tumor types can be consulted in the web-based Supplementary material).

Discussion

Projections of the incidence of cancer are helpful in assessing the future burden of cancer and in order to establish appropriate cancer control plans to cope with the challenge posed by a growing number of cancer patients. The projections carried out in GLOBOCAN by IARC, combined with the evidence-based data on radiotherapy indications offer a unique opportunity to undertake long-term radiotherapy resource planning. The obtained data, by tumor site and by country within Europe, give guidance for making the necessary investments in services and equipment and for setting-up training of dedicated personnel, necessary actions to adequately manage the increased radiotherapy demands expected in the near future.

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