Report on the seventh European Particle Therapy Network workshop

22 October 2021, online

The seventh European Particle Therapy Network (EPTN) virtual workshop was attended by 48 participants.

The Covid-19 pandemic has greatly influenced societies and healthcare worldwide. In this newsletter, you can read about two surveys that have been conducted among members of the particle therapeutics community. The results seem to indicate that our community has responded robustly to the pandemic challenge, with only minor implications for daily activities, referrals and the fraction schedules that have been used.

Since the last annual meeting, which was held online in October 2020, the EPTN has been further involved in the European Commission's steering group on health promotion, disease prevention and management of non-communicable diseases through its sub-group on proton therapy. This sub-group is co-chaired by representatives of the directorate-general of health and food safety (DG SANTE) and the European Investment Bank (EIB). At a sub-group meeting in 2021, it was confirmed that possible investment in proton therapy had been put on hold until the need for/benefit of proton therapy was confirmed. On the other hand, the EIB is willing to support a new research project on proton therapy with the European Commission and the European atomic energy community (EURATOM). Further details will be discussed during the next meeting with the EIB in January.

Publications:

We are glad to see continued activity in the working groups that has resulted in the publication of several papers and scientific reports. In future, we will highlight the publications on our homepage www.estro.org/Science/EPTN .

1. Eekers DBP, et al. Update of the EPTN atlas for CT- and MR-based contouring in neuro-oncology. Radiother Oncol 2021; 160: 259-265. https://doi.org/10.1016/j.radonc.2021.05.013

2. Sørensen BS, et al. Does the uncertainty in relative biological effectiveness affect patient treatment in proton therapy? Radiother Oncol 2021; 163: 177-84. https://doi.org/10.1016/j.radonc.2021.08.016

3. Heuchel L, et al. Is a variable proton RBE considered in clinical practice? - ESTRO survey among 25 proton centres. Radiother Oncol 2021; 161(Suppl.1) S313-314. DOI: 10.1016/S0167-8140(21)06904-8.

We look forward to a productive year for the network in 2022, and hope that we can have a face-to-face annual workshop in the autumn. The provisional date is set for 5 October 2022. It will be a one-day meeting in a central location in Europe.

You can read about the Covid-19 surveys, progress across our seven working parties, updates from EU projects and other initiatives of interest to the network at this link >>>

Damien Weber, Cai Grau and Dietmar Georg
Co-chairs, EPTN task force

Damien Weber, Switzerland

Cai Grau, Denmark

Dietmar Georg, Austria

RESEARCH PROJECTS

A year of pandemic for European particle radiotherapy: a survey on behalf of the EPTN working group

Ester Orlandi, Italy

A survey was launched in April 2021 to investigate the strategies or solutions that had been adopted during the pandemic in particle radiotherapy centres. The survey was performed on behalf of the EPTN working group. We aimed to compare conditions between two periods: the pre-Covid months (from March 2019 to February 2020) and during the first two waves of the outbreak (from March 2020 to August 2020 and from September 2020 to February 2021). The comparison between the two phases was related to two main topics:

- an assessment of the impact on the workflow of physicians and healthcare professionals; and
- an assessment of the management of patients (first clinical evaluations, multidisciplinary discussions, follow-up evaluations, and treatments).

Nine centres (two from Italy, two from France, and one each from The Netherlands, Belgium, Germany, Denmark and Austria) completed the survey.

Remote working solutions, staff having been furloughed and online meetings were arranged to reduce the impact of the pandemic. Multidisciplinary board discussions regarding tumours continued virtually during the outbreak in order to guarantee continued care. In three centres, radiation oncologists were involved in shifts in dedicated Covid-19 departments during both waves.

Compared with the pre-Covid period, the numbers of in-person first evaluations and follow-up visits were reduced during the two studied waves. In most centres, the reduction in the number of evaluations was greater than 6%, whereas the figures for follow-up visits varied: one centre reported a fall of less than 5%, most (five institutions) reported reductions of between 5% and 10%, two reported reductions of between 10% and 20% and one centre stated that the number of follow-up visits had been cut by more than 20%. This fall in the numbers of face-to-face assessments was reflected in the implementation of telemedicine.

The total number of treatments fell; however, the number of particle treatments was slightly increased while the number of photon treatments decreased in all centres. In addition, hypofractionation, when applicable, was preferred.

The results of this survey showed that European particle radiotherapy centres showed a rapid, effective and resilient reaction to the healthcare crisis.

Covid-19 survey

Esther Troost, Germany

A survey on SARS-CoV-2 protocols that had been drawn up in particle therapy departments was launched at the start of the outbreak in March 2020 to observe the consequences of the pandemic on workflows, staffing, patient selection etc. and to consider whether fractionation schedules would be altered in proton therapy.

Two rounds of questionnaires were circulated in March and May; 12 centres answered. Two further rounds of the survey were planned for November 2020 and early 2021. The aim was to publish a white paper on the findings shortly thereafter.

However, the third round of the survey did not take place as the results from the first two rounds did not suggest that practices such as hypofractionation procedures had changed. Nevertheless, the initiators of the survey consider that it would be worthwhile to publish the results of the survey in a short letter in the Radiotherapy and Oncology journal of the European SocieTy for Radiotherapy and Oncology (ESTRO).

Working Party 1: clinical

Hans Langendijk, The Netherlands

WP1 has two tasks. The first is to produce a white paper on methodological issues that are encountered in clinical studies for the validation of the added value of proton therapy, either using classical approaches (phase I, II, III studies) or alternative methods. To this purpose, a first virtual meeting will be organised in the first quarter of 2022 with representatives of the EPTN centres and experts in the field of statistics in epidemiology.

Hans Langendijk
On behalf of WP1 coordinators

Working Party 2: dose assessment, quality assurance, dummy runs, technology inventory

Sairos Safai, Switzerland; Oliver Jäkel, Germany; Stefano Lorentini, Italy

As of October 2021, 38 participants were contributing to WP2, from 27 centres based in 12 countries.

The fourth workshop of WP2 was held in December 2020, online for the first time. Two projects relevant to WP2, which were supported by the inspire (transnational access) project, were presented and discussed. These were the project by the National Physical Laboratory (NPL, UK) on absolute dosimetry in scanned proton beams, which uses the NPL primary-standard graphite calorimeter, and the project by MedAustron on dosimetry audits, which involves use of a dedicated anthropomorphic phantom.

The flexibility and inherent simplicity of holding and organising online events prompted the decision to repeat such interactions regularly within WP2. It was therefore decided to organise two workshops each year rather than one. One would be online to discuss updates regarding the running of activities and organisational aspects; and one would be in-person on a specific theme, similar to the one that was organised on quality assurance (QA) in 2019. A brief survey among the members of the network has identified the following topics for future thematic workshops:

- ultra-high-dose-rate dosimetry;
- update on implementation of the international code of practice on dosimetry in radiotherapy (technical report series (TRS) 398 from the International Atomic Energy Agency (IAEA));
- the use of Monte Carlo simulations and logfiles in QA; and
- patient-specific QA.

An inventory of dosimetry equipment was launched in January 2020. The purpose was to create a list of commercial equipment used for QA by each participating centre. The very pragmatic intent is to enable exchange of experience between users regarding trouble shooting, best use of equipment, commissioning, etc.

The second thematic WP2 workshop took place on 6 May 2021 as an online event. It was organised by Lorenzo Placidi (Italy) on ultra-high-dose-rate (FLASH) dosimetry, in line with the findings of the abovementioned survey. Whether FLASH effects can be observed also in proton therapy has become a relevant research question in recent years that is being investigated in several proton centres across Europe and the US. Accurate knowledge of the dose delivered to biological samples at ultra-high dose rates is central to the finding of any conclusive results, but it is critically challenged by the performance of reference chambers operated at non-standard conditions. Centres that are interested in the performance of such experiments are confronted with these dosimetric challenges, since no guidelines or references are available at the moment. We therefore believe that it was the right time to bring together centres that were beginning to have first-hand experience in high-dose-rate dosimetry. The focus of the workshop was therefore on dosimetry and not on the actual FLASH effect. The talks were structured to cover the following three aspects:

1. dosimeters that are used and characterised under ultra-high-dose-rate conditions: Gafchromic™ films, scintillator foils, ionisation chambers, optically stimulated luminescent dosimeters (OSLD), synthetic microDiamond detectors, alanine and Faraday cup;
2. beam line descriptions and calibration of beam monitoring systems; and
3. experimental set-ups for cells and small animals.

The workshop was well received and over 60 people took part.

The update of the code of practice, which was issued by the IAEA in 2000, is in progress. The final draft was circulated for external review and was finalised by July 2021. The IAEA is working on the final document, but no publication date has yet been announced. The most important part of the update (at least for practical purposes) will probably be the revised recommendations for kQ-values of various chambers in proton and ion beams and their respective uncertainties. Some other important aspects, such as procedures to monitor calibration or for the determination of recombination effects, are part of two supplements for protons and light ions. These supplements are or will be made available through a request form on the IAEA's website.

The proton dosimetry supplement has been available since May 2021, while the light-ion supplement is finalised and expected very soon. Therefore, WP2 has decided that it will be timely to hold a workshop on the update of TRS-398 early next year. The Danish proton therapy centre in Aarhus has volunteered to host this meeting in a hybrid format. The workshop will run over two consecutive half days, with a practical exercise on beam calibration on one day and informative talks on the other day. The idea is to discuss the expected changes in the TRS-398 guideline and their impact on dosimetry procedures. We are currently in the process of putting the agenda together and reaching out to speakers.

The yearly meeting of the WP2 on updates regarding the running of activities and on organisational aspects will be held online this month.

Sairos Safai, Oliver Jäkel, Stefano Lorentini
On behalf of WP2 coordinators

Working Party 3: education

Morten Høyer, Denmark

The focal activity for WP3 is to provide training and educational opportunities for radiation oncology professionals who are already involved in, or are at least approaching, the field of particle therapy.

The specific form of training events that we would like to trial are short (two to three day) workshops, open to a small number of participants (30 people maximum), dedicated to a specific disease site, in which we discuss the specific issues of particle therapy in a way that is relevant to clinicians, medical physicists and radiotherapists. We hope that with such a set-up it will be possible to address detailed aspects and to get as close as possible to a "hands-on" experience, e.g. by discussing how to contour, plan and treat specific cases.

These workshops are meant to complement, not to replace, the ESTRO school course on clinical particle therapy, which remains the main educational ESTRO event on particle therapy and which represents an excellent starting point for those who are approaching the field of particles.

The first workshop will be on brain and base-of-skull tumours and will be hosted by the Paul Scherrer Institute (PSI) in Switzerland. During the workshop we will discuss topics such as patient selection, contouring atlases, techniques for immobilisation and imaging, how to handle uncertainties in treatment planning, etc.

We initially set a date for spring 2021, but due to the pandemic situation we had to postpone to October 2021. That date also became incompatible with the Covid situation in several European countries, so unfortunately we had to cancel the event. We are now finalising the dates for the workshop finally to happen in spring 2022.

If this first workshop test is successful, our plan is to design a series of periodic events, in which other disease sites will be discussed at other locations in Europe. We aim overall to run one or two workshops per year.

Morten Høyer
On behalf of WP3 coordinators

Working Party 4: image guidance in particle therapy

Aswin Hoffmann, Germany; Alessandra Bolsi, Switzerland

Image guidance for particle therapy (IGPT) is essential to guarantee accurate dose delivery and to minimise the effects of range uncertainties that are related to patient misalignment and anatomical changes that occur during the course of therapy. Multiple imaging modalities for IGPT are available and routinely used clinically. However, due to a lack of standardised procedures for IGPT, most centres have developed their own strategies, which are based on their available infrastructure, technical implementation and dose delivery methods. The need to collaborate among centres has been recognised and centres have set two primary goals: 1) to develop clinical consensus guidelines for IGPT; and 2) to pursue research projects to optimise existing IGPT techniques and to develop new ones. Within WP4, particle therapy professionals from different disciplines have teamed up in body-site-specific sub-working groups. These groups are constantly being expanded with colleagues from European centres who are interested in IGPT-related topics.

As a first step in the development of clinical consensus guidelines, it is the aim of WP4 to gain insight into the current clinical practice parameters of IGPT in European particle therapy centres. To this end, multiple detailed surveys for specific localisations, classified as abdomen, prostate, brain, breast, cranio-spinal irradiation (CSI) and extremities, were sent out to the participating centres in 2019-20. Response data have been collected and are currently being analysed by the respective body-site-specific sub-working groups to identify common procedures, their limitations and potential improvements. Preliminary results from the summary response data will be shared between the WP4 sub-working groups before the end of 2021.

Members had identified a strong need for consensus guidelines on IGPT of CSI, due to its widespread application and the time-consuming nature of IGPT procedures. Therefore, a comprehensive literature review was initiated. Specific topics that have been addressed in this review are: patient immobilisation, imaging techniques and protocols, patient-positioning verification and robustness. To draft the consensus guidelines, the data obtained from the literature review will be combined with the response data from the survey.

A first IGPT research project that involves multi-centre evaluation of the inter- and intra-fraction patient-positioning accuracy for brain tumour patients undergoing particle therapy has been initiated. The study aims and endpoints are currently being defined within the working party. A call to participate in this study will be launched in early 2022.

Due to the Covid-19 pandemic, the annual WP4 workshop was moved to 2022. Instead, online sessions with the sub-working group coordinators were held. The fourth annual workshop has now provisionally been scheduled to take place at MedAustron in Wiener Neustadt (Austria) on 21-22 April 2022. The official announcement will be made early next year.

A status update of the work done by WP4 was presented during the ESTRO 41 conference in Madrid.

Aswin Hoffmann and Alessandra Bolsi
On behalf of the WP4 coordinators

Working Party 5: treatment planning systems in particle therapy

Anthony Lomax, Switzerland

Treatment planning systems are essential to ensure that particle therapy is accurate and effective, and they are an important part of the particle therapy workflow. The aim of this working party is to review and provide recommendations on numerous aspects of the treatment planning process.

WP5 was initially split into groups to consider six main subjects:

- collective TPS specifications;
- planning standards and case solutions (together with Italy, Poland, Austria, Czech Republic and Sweden (IPACS));
- TPS commissioning and validation;
- alternatives to patient-specific verifications;
- computed tomography/Hounsfield unit (CT/HU) calibration; and
- robustness analysis.

Two new subject groups have now been added:

- the role of linear energy transfer (LET) and
- 4D planning.

Collective TPS specifications

These have been defined, they have been published on the ESTRO website and a questionnaire on future developments in TPS has been sent to different TPS vendors. The questions asked are listed below.

Implementation of more accurate dose calculation algorithms (MC or other):	**Your view on robust optimization (and analysis):**
·How important is it to develop more accurate algorithms?	·How important do you consider robust optimization (in the sense we know it today)?
·Is there a need to also improve the algorithms used in the optimizer?	·How could/should robust optimisation be improved?
·How important is the speed of these algorithms and what is your strategy for/view on the conflict between fast algorithms … and high accuracy?	·Do you see a need for/possibility of Spot position optimisation?
·Is the trend inevitably towards more use of Monte Carlo or will the need for increased speed make further improvement in analytical algorithms more viable?	·If the proton system could change the spot size from one spot to another, would it then make sense to include spot size in the optimisation process?
·Is it likely, according to you, that MC algorithms will be the dominating algorithm within, say, the coming 10 years?	·Are there other parameters that you think should be included in the optimisation process?
	·Would it be interesting to optimize protons and photons together?
Handling of a variable RBE/LET:	**Your view on adaptive planning:**
·Will it be important to offer calculated dose distributions with an RBE different from the generic 1.1?	·Will real time adaption be possible within the coming years and will there be a need for this ("real-time" in sense having the patient on the couch while making a new adapted plan)?
·Will it be important to offer calculated dose distributions with an RBE different from the generic 1.1? If so, what concept do you have in mind?	·To achieve this, what would be needed apart from fast algorithms?
·Would it be necessary to implement that RBE option also in the optimiser?	·According to you, how "automatic" will it be possible to make proton treatment planning?
·Will calculation of LET be important and if so, instead of RBE calculations or as a complement?	Would it be possible to provide non-proton clinics with easy-to-use software that could produce proton plans of a clinical relevant quality? Would it be desirable
·Should LET calculation be based on dose-averaging or track-averaging?	
·Should the LET calculation be part of the optimization or is it enough to use it for visualisation?	**Artefact handling from implants**
·What would be the best method to combine dose and LET?	
	Other important areas not addressed above

Four vendors responded and the results are currently being collated and analysed.

Planning standards and case solutions

This group collaborates with the IPACS group; indeed, most of the work has already been done by the IPACS group. Planning comparisons for a head-and-neck case have been performed within the IPACS group, and the results of this work have been published (Stock et al., Acta Oncol. 2019; 12: 1720-1730). With the inspire project, a 'blind' treatment planning study is being organised by the University of Groningen and PSI. This will be a three-level comparison study in which we hope all EPTN members will participate. The study will consist of three steps:

1. send the CT/structures to clinics, which will then plan using their own protocols, dose prescriptions and constraints;
2. define strict prescriptions based on the Dutch protocols, based on which the clinics will replan. After this step, a meeting will be organised at which the results will be discussed so that a kind of consensus can be defined; and
3. provide dose distributions, which will be based on the findings of that consensus meeting.

The case to be planned is currently being prepared and will be sent to all centres in the coming weeks.

Alternatives to patient-specific verifications (PSV)

After the successful workshop that was held at PSI in 2019, a follow-up workshop will be organised in the first quarter of 2022 to re-evaluate the status of patient-specific quality assurance in the different EPTN centres. In particular, the second workshop will concentrate on two issues:

1. gamma evaluation criteria and their standardisation, and
2. the potential and use of log-file-based verifications.

CT/HU calibration

This has been a very active task group. It has recently published an important inter-centre comparison of CT calibration procedures (Peters et al., Radiother. Oncol. 2021, 163: 7-13). This was the first European study of its kind and was very well supported by the EPTN community (17 centres participated). Quite large deviations between centres were observed, and the paper makes specific recommendations for improvement.

Robustness analysis

A meeting of this sub-group has just taken place (22 October 2021), at which a multi-centre study on plan robustness was discussed. It is proposed that this study could be performed as follows:

1. single case to be sent to participating centres, together with planning objectives and constraints;
2. each centre optimises a plan using their standard planning approaches (e.g. planning treatment volume, robust optimisation, hybrid);
3. the robustness of the results are analysed at one centre (Université Catholique de Louvain, Belgium) through use of Monte Carlo simulation (MCsquared).

The Holland Particle Therapy Center (The Netherlands) is currently defining a case for this study, and the Katholieke Universiteit Leuven (Belgium) will look into the deployment of MC-squared to participating centres.

The role of LET

The first meeting of this new task group took place in June this year, at which the aims of the group were defined. These are summarised in the following table.

Aim 1a: Assess differences in LET scoring methodology implemented in treatment planning systems and secondary dose calculation systems.
Aim 1b: Define recommendations for LET scoring metrics to be implemented in treatment planning systems and secondary dose calculation systems.
Aim 2a: Review available MC calculation engines for LET calculation
Aim 2b: Make technical recommendations towards clinical implementation of LET calculation engines.
Aim 3: Identify treatment sites which may benefit from LET evaluation and optimization guided biological treatment planning.
Aim 4: LET/RBE Clinical Practice

4D planning

This is another new task group formed as part of WP5, which aims to answer the following questions:

1. what is 4D planning?;
2. is it used clinically, and for which indications?; and
3. how should 4D treatment guidelines and evaluation guidelines be defined? (This question will be considered in coordination with the thoracic taskforce of the particle therapy co-operative group.

The annual 4D workshop for particle therapy took place in Delft (The Netherlands) on 12-13 November, and a first review paper on the clinical use of 4D and robust optimisation was submitted to the Green Journal in November 2021.

Next steps for WP5

Several new directions for WP5 are being considered, including the formation of a new task group on adaptive processes and workflows, the drawing up of a more precise definition of the role of automatic treatment planning, performance of reviews of optimisation objectives and algorithms, and consideration of the role and validation of deformable registration algorithms. Finally, we need a new co-chair for this group, as Hakan Nystrom has asked to stand down.

Tony Lomax and Hakan Nystrom
WP5 coordinators

Working Party 6: radiobiology and relative biological effectiveness

Brita Singers Sørensen, Denmark

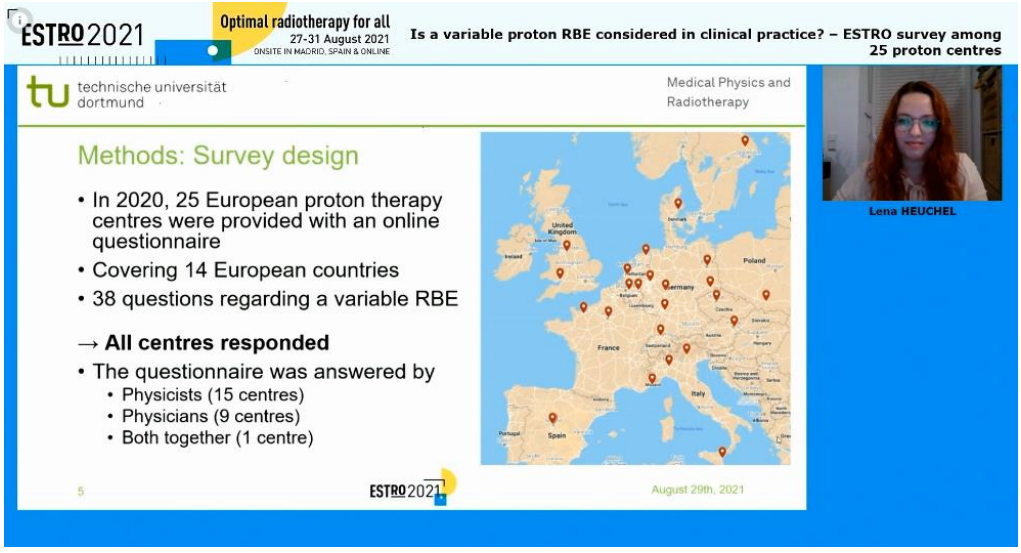
Protons and heavier charged particles act differently biologically compared with photon irradiation. Part of this difference is accounted for in the concept of relative biological effectiveness (RBE). Currently proton irradiation is given an RBE value of 1.1 clinically, but this figure is under debate, as it is a simplification of the actual biological response to proton irradiation. The RBE is known to be affected by tissue type, dose and fractionation as well as the LET. In a proton treatment field, the LET increases moderately through the spread-out Bragg peak (SOBP) but increases considerably at the very distal edge of the SOBP, and this phenomenon has been demonstrated in vitro to translate into an increased distal edge RBE. This is a critical issue, as the distal edge of an SOBP in a patient treatment plan may be located in the normal tissue that surrounds the tumour. This increase in RBE has been a subject of discussion, as the clinical impact has been unclear.

In February 2020, WP6 organised a workshop in Manchester (UK) with local co-organisation by Karen Kirkby and team and support from the inspire project (https://protonsinspire.eu/). It was arranged as an open meeting for everybody with an interest in the clinical impact of the RBE and in experimental particle radiobiology, and 44 participants from eight countries and 13 centres attended the two-day meeting.

The first day of the meeting was focused on RBE and radiobiology, which covered the clinical perspective and use of a variable proton RBE. The subject was addressed in four sessions, which considered: (1) the clinical problem – the significance of elevated RBE in proton therapy; (2) current clinical practice; (3) back-translation from clinics to radiobiology research; and (4) ways in which we can implement RBE in clinical treatment planning.

During these sessions, the current experimental and clinical data were presented and discussed. Representatives from seven clinical centres involved in patient treatment laid out the current clinical practice regarding the risk of a variable RBE in their centres. The overview revealed the use of different strategies, which ranged from delivering more than one field, through focusing on placement of the distal edge outside any organ at risk, to evaluating the LET distribution in treatment plans for individual patients. This has been the subject of a review paper, recently published in *Radiotherapy and Oncology* [1].

To follow-up on the workshop, WP6 and Armin Lühr, coordinator of working party 9 of the inspire project on mathematical modelling and simulation, conducted a survey on current clinical practice regarding RBE in European particle therapy centres. The questions in the survey covered treatment planning, prescription and RBE strategies, and were aimed at formation of an overview on whether RBE and LET were taken into account in clinical practice in European particle therapy centres and if so, how this was done in practical terms. All European centres were invited to take part in the survey, and all centres responded. The first data from the survey were presented at ESTRO2021, in a presentation by Lena Heuchel (Germany) [2]. The main findings were that almost all centres considered a variable proton RBE, particularly for organs at risk, but did not necessarily apply it. Most of these centres stated that they chose beam angles carefully to avoid an increase in risk. To move forward, they called for more clinical proton RBE data and tools to calculate LET and RBE during treatment planning.



Presentation by Lena Heuchel at ESTRO2021 on the recent survey regarding use of proton RBE in clinical practice.

1. Sørensen BS, Pawelke J, Bauer J, Burnet NG, Dasu A, Høyer M, et al. Does the uncertainty in relative biological effectiveness affect patient treatment in proton therapy? Radiother Oncol 2021;163:177–84.
2. Heuchel L, Hahn C, Pawelke J, Sørensen BS, Dosanjh M, Lühr A. Is a variable proton RBE considered in clinical practice? - ESTRO survey among 25 proton centres. Radiother Oncol **161**(Suppl.1) (2021) S313-314, DOI: 10.1016/S0167-8140(21)06904-8.

Brita Singers Sørensen
On behalf of WP6 coordinators

Working Party 7: health economy

Norman Kirkby, UK

Report from Yolande Lievens (Belgium), Norman Kirkby (UK) and Noémie Defourny (UK)

As discussed previously, this working party aims to focus on cost accounting first; costs that in a second step can be used to support an economic evaluation of health. Ideally, an approach should be followed that enables alignment with the work already performed in the health economics in radiation oncology (HERO) group, by using the time-driven, activity-based costing (TD-ABC) methodology.

In order to address the first theme of WP7, a TD-ABC exercise has recently commenced at the Christie Hospital Proton Beam Therapy Centre and the University of Manchester, under the supervision of Professor Kirkby and in collaboration with Dr Defourny. Dr Defourny did her PhD on TD-ABC in photon therapy in the context of the HERO project.

This exercise will aid in the understanding of the cost base, and subsequently the cost-effectiveness, of proton beam therapy (PBT), and it will establish a base-line methodology that can be extended to other centres across Europe. It is accepted that the current exercise may be more granular than the eventual protocol for TD-ABC in proton therapy will be at European level, but it uses the care pathways and workflow model that was used to establish the Christie PBT centre. Sensitivity analysis on this model and its results will guide the refinement and simplifications that will be required for the eventual European protocol. To this end, the Christie team, with the WP7 chairs, are very keen to start early collaboration with other proton therapy centres to ensure that the work is fit for purpose more generally.

Norman Kirkby (UK)
On behalf of WP7 coordinators

EPTN WP Coordinators

WP	Title	Coordinators
1	Clinical	Hans Langendijk (Groningen, The Netherlands) - leader Roberto Orecchia (Milano, Italy) Karin Hausterman (Leuven, Belgium) Daniel Zips (Tuebingen, Germany) Jacques Balosso (Grenoble, France) Esther Troost (Dresden, Germany)
2	Dose assessment, quality assurance, dummy runs, technology inventory	Oliver Jäckel (Heidelberg, Germany) Sairos Safai (Villigen, Switzerland) Stefano Lorentini (Trento, Italy)
3	Education	Morten Høyer (Aarhus, Denmark) Marco Schwarz (Trento, Italy)
4	Image guidance in particle therapy	Aswin Hoffmann (Dresden, Germany) Alessandra Bolsi (Villigen, Switzerland)
5	TPS in particle therapy	Håkan Nyström (Uppsala, Sweden) Tony Lomax (Villigen, Switzerland)
6	Radiobiology, RBE	Manjit Dosanjh (Geneva, Switzerland) Bleddyn Jones (Oxford, UK) Jörg Pawelke (Dresden, Germany) Martin Pruschy (Zurich, Switzerland) Brita S. Sørensen (Aarhus, Denmark)
7	Health economy	Yolande Lievens (Ghent, Belgium) Klaus Nagels (Bayreuth, Germany)

European Proton Therapy Database ParticleCare (E2RADIatE-EORTC 1813)

Vincent Grégoire, France

A structured survey was conducted with nine particle therapy centres to sense their interest in participating in a pan-European data registry. The centres were selected based on geographical distribution, the magnitude of their clinical activities and their involvement in the European networks (ESTRO, European Organisation for the Research and Treatment of Cancer (EORTC)). All nine centres have agreed to share data in a two-step process; generic data will be shared first and in-depth data in a second step.

Some legal and ethical issues linked to the data-sharing aspects are being addressed with EORTC before data from the nine centres is transferred to the EORTC database. A transfer of a pilot (fake) dataset from OncoRay to the EORTC database will be used to test the system. After that, the testing will continue with the transfer of a second (fake) dataset before the transfer of real data from the nine centres takes place.

The testing phase is expected to be completed by the end of 2021 and the transfer of real data is expected to start at the beginning of 2022 for the tested institution.

Collaborative EU projects

Proton versus photon therapy for oesophageal cancer (PROTECT)

PROTECT compares the clinical outcomes of proton therapy and state-of-the-art photon radiotherapy for locally advanced oesophageal cancer. In the PROTECT trial, the potential benefits of proton therapy will be tested in a trimodality treatment of radiotherapy, chemotherapy and surgery.

A total of 19 public and industry partners across Europe are joining forces in this ambitious collaborative clinical research project. The aim is to set new standards for the clinical use of proton radiotherapy.

The partnership behind the PROTECT trial has engaged 13 recruiting units, 38 institutions, 12 particle therapy facilities, 25 sub-sites and two major particle therapy equipment manufacturers. The project has received funding from the innovative medicines initiative, the European Federation of Pharmaceutical Industries and Associations, and the companies Ion Beam Applications (IBA) and Varian, part of Siemens Healthineers. It is the first public-private partnership in which funding from the industry has been matched by funding from the EU.

The funding was approved in July 2021. The project, which comprises 11 working groups, is expected to take six years.

Real-time adaptive particle therapy of cancer (RAPTOR)

RAPTOR is an EU horizon 2020-funded programme. It was initially headed by the University of Groningen and subsequently by PSI with, as principal investigator, Francesca Albertini. The project brings together 13 beneficiaries and 15 partner organisations. The aim is to bring adaptive particle therapy to the clinic.

The project plan comprises an adaptation loop (imaging, verification, intervention), training and dissemination working groups. All PhD students have now been recruited, and as an initial training session, the first meeting of the RAPTOR school will take place on 13-17 December 2021 in Munich.

Heavy ion therapy research integration-plus (HITRIplus) project

HITRIplus (https://hitriplus.eu/) is a four-year research project funded by the European Commission under the horizon 2020 programme (H2020-INFRAIA-2020-1). The project, which started on 1 April 2021, aims to integrate and propel forward biophysics and medical research on cancer treatment that uses heavy-ion beams while jointly developing its sophisticated instruments. Through transnational access, HITRIplus gives a unique opportunity to European hospitals and oncology institutes to gain access to and share clinical expertise in heavy-ion therapy through the creation of links among clinicians who refer patients to hadron-therapy facilities. The project aims to attract universities, research centres and hospitals to use the beam time and research facilities of the heavy-ion centres. Its networks will structure and foster clinical and pre-clinical research on heavy-ion therapy. Joint research activities are developing new accelerator and beam-delivery technologies to extend the reach of the present generation of centres and to define a new European reference design, at lower cost and dimensions, to make ion therapy for cancer more accessible and to open new markets to European industry.

Presentation of new clinical trials and other initiatives of interest for EPTN

Should EPTN investigate how patient age and risk of secondary cancer is handled in European centres?

Morten Høyer, Denmark

In Denmark there is a lot of discussion among multidisciplinary cancer groups (prostate, brain, head and neck, breast cancer) on this topic, but the approach within each group is different. A common approach is required based on principles such as patients' ages, co-morbidity genetics, volume, dose etc. The University of Groningen and the Danish Center for Particle Therapy are the initiators of the project. They plan to hold one to two workshops to address this topic. The outcome of the first workshop would be to define the frame for a survey to be sent to particle therapy centres via the EPTN network.

It is agreed among collaborators that moving this to a European level would be beneficial. This could result in the publication of a paper/ recommendations on the approach at European level.

Those interested in collaborating in this initiative may contact Mortem Hoyer or the EPTN coordinators.

Surveying European clinical practice in pencil-beam scanning irradiation of paediatric posterior fossa tumours

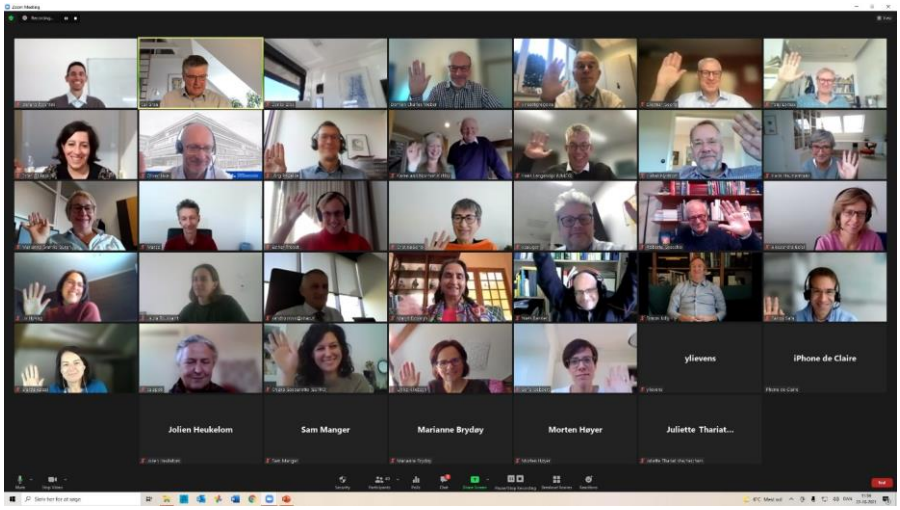
Laura Virginie Toussaint, Denmark

A survey on clinical practices that are used in the irradiation of posterior fossa tumours was distributed in September 2021 to European proton therapy centres that currently treat paediatric patients with pencil-beam scanning. The main items that were assessed were levels of clinical experience at the participating centres, patient positioning and imaging protocols, definitions of organs at risk, beam arrangements, treatment planning processes, the applied dose constraints (including RBE/LET considerations) and clinical follow-up. This initiative was presented to the EPTN at its annual workshop in October 2021.

Concluding remarks

The network has come a long way towards meeting its goal to increase collaboration between researchers and clinicians. Meetings such as this workshop demonstrate just how much this collaboration is necessary. New initiatives are being launched and funding is being obtained to run these activities and initiatives.
It is important to increase the visibility of the network, and, in this respect, it is essential to mention the network in abstracts/publications etc.

See you all at the next annual workshop of EPTN on 5 October 2022.



Selected participants from the online 2021 EPTN meeting