



Breaking Cancer Barriers:

Proton Beam Therapy in the UK

BY RUTHERFORD HEALTH PLC

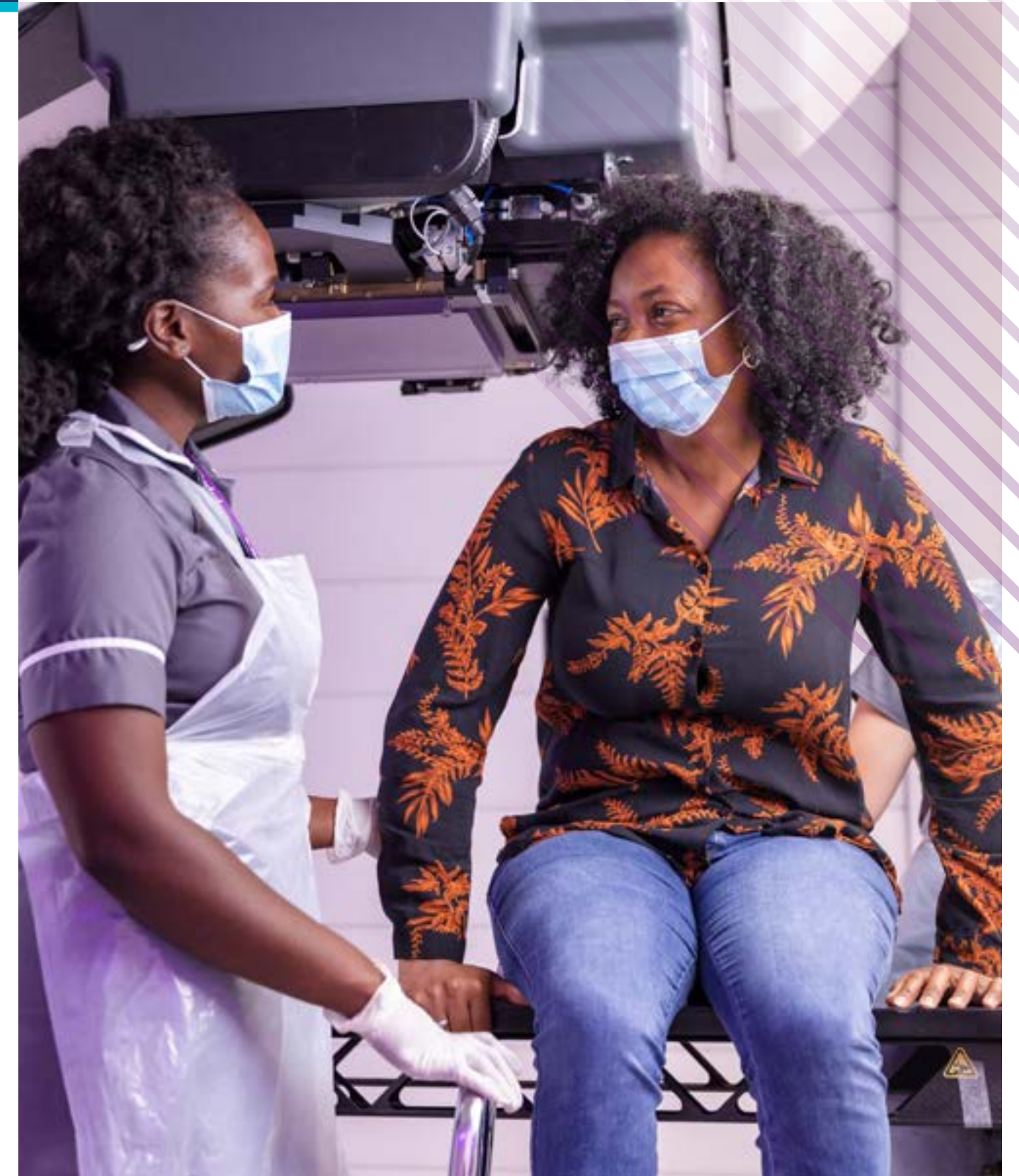
Executive Summary

The treatment of cancer remains one of the greatest challenges in medical science.

The incidence of cancer and mortality rates in the UK means that maximum effort is continually required to secure the best possible outcomes for patients. This report assesses the role that proton beam therapy is now playing in the range of advanced cancer treatments available in the UK.

Key findings include:

- In just three years, the UK capacity for treating patients with high energy proton beam therapy has gone from zero to four fully operational centres capable of treating over 2,000 patients annually.
- Proton beam therapy services in the UK are primarily delivered through the Rutherford Cancer Centres (RCCs) and the NHS (there are three operational RCCs and one NHS facility). Further facilities are planned in both the public and independent healthcare sectors.
- The nationwide cancer backlog created by the Covid-19 pandemic will remain a major challenge and proton beam therapy can play an important role in meeting this challenge.
- There is clear evidence of increased patient demand for proton beam therapy in the UK.
- The number of oncologists being trained in the delivery of proton beam therapy has risen across the UK.
- The UK is set to reap an 'innovation dividend' through the creation of a better skilled and better prepared workforce including radiographers, physicists and oncologists.
- The need to send patients abroad for treatment has been reduced dramatically.
- The cost of proton beam therapy continues to reduce and initial expenditure can be offset by less ongoing treatment for patients over the medium and long-term.
- Health Insurers are now increasingly supporting the funding of proton beam therapy.
- The gap between provision of proton beam therapy in the UK and European counterparts is closing and there is still scope for more service provision in the UK.



What is Proton Beam Therapy?

Proton beam therapy is a type of radiotherapy used in cancer treatment, delivering beams of protons (charged particles) rather than traditional X-ray beams (photons) to irradiate tumours in a more targeted manner and reduce damage to peripheral tissue and organs.

The UK has had a 'low energy' proton beam therapy facility since 1989 at the Clatterbridge Cancer Centre in Liverpool which specialises in treating cancers of the eye ('low energy' protons provide treatment at a very shallow depth). This report is focused on 'high energy' proton beam therapy which can be used to treat a wide range of cancers anywhere in the body.

Both proton and conventional radiation therapies work by delivering ionising radiation dose to cells and tissues which damages or kills those cells and tissues. By targeting dose to the tumour cells cancer can be treated and cured. However, there is always some radiation dose (causing damage) to surrounding tissues leading to the side-effects associated with radiotherapy. The challenge in radiotherapy is to target the dose as much as possible to the tumour and reduce as much as possible the dose to surrounding healthy organs and tissues.

The advantage of high energy proton beams lies in the fact that their energy can be tuned so the protons stop at a specific point in the body, sparing critical radiosensitive tissue adjacent to the cancer. The ability of proton beam therapy to accurately target cancerous cells means it can help reduce side effects and is considered one of the most advanced forms of radiation therapy available today.

Before they reach the cancer, both proton and conventional radiation beams have to make their way through the patient's skin and surrounding tissues. X-ray photons have no mass or charge and so X-ray beams are highly penetrating and pass all the way through the patient, delivering dose all the way through.

Tumours are usually located deep in the body and photons deliver dose (causing damage) to healthy cells before reaching the tumour, then deliver dose to the tumour, then continue past the tumour delivering dose to healthy cells beyond the tumour all the way until they leave the patient's body. The dose delivered by X-ray beams beyond the tumour is called 'exit dose'.

In practice an arrangement of several X-ray beams or an arcing X-ray beam (e.g. 'VMAT') is used to target the high dose to the tumour, but this has the disadvantage of spreading out the dose, giving a low radiation dose to the whole area around the tumour (e.g. a 360° VMAT treatment to the prostate will give a low dose to the whole pelvis) – this is referred to as the 'low dose bath'.

The energy of a proton beam on the other hand can be tuned to deliver maximum dose to the tumour with less dose to healthy tissue in front of the tumour and no dose at all to healthy tissue behind the tumour. This property of proton beam therapy (the ability of protons to stop at a specific depth dependent on the energy of the incident proton beam) is known as the 'Bragg peak'.



The primary benefits of proton beam therapy are:

- Lower radiation dose to healthy tissue in front of the tumour.
- Little to no radiation dose behind (or around) the tumour.
- Potential to lower the risk of side-effects.
- Improvement to quality of life during and after treatment.
- Reduced risk of secondary cancers.

The range of published estimates for the optimal utilisation of protons in radical radiotherapy (when radiation is given with the aim of completely eradicating the cancer) ranges from 1% (UK, NHS) to 20% in the US. Recent policy studies from several European countries indicate a 10-15% conversion to protons in patients treated with radiotherapy with radical intent. There are more than 150,000 cancer patients in the UK every year who are treated with radiation therapy, of which well over 90,000 require radical radiotherapy. A significant number of these patients could be better treated with proton beam therapy.

With the growth of high energy proton beam therapy in the UK, more patients can benefit with a greater emphasis on quality of life.



Proton Beam Therapy availability in the UK

The UK was one of the last European countries to establish an operational proton therapy service but there has been significant growth in capability in the last three years.

From 2008 until 2018, patients were sent abroad, to the United States, Switzerland or Germany for treatment. The Covid-19 pandemic halted treatment abroad.

Rutherford Health introduced high energy proton beam therapy to the UK in 2018 through its facility, the Rutherford Cancer Centre South Wales. The Wales centre alone has treated hundreds of patients with proton beam therapy and has an agreement with the Welsh Government that sees NHS Wales adult patients offered proton beam therapy at the centre.

There are now four fully operational Rutherford Cancer Centres in the UK: South Wales, North East, Thames Valley, and the Rutherford Cancer Centre North West (PBT services 2022).

This year (2021) has seen a 45% increase in the number of patients coming to the Rutherford Health network compared to last year despite a significant reduction in the number of patients being diagnosed due to the pandemic, suggesting growing demand for advanced cancer therapies from the public.

Since opening, Rutherford Health's network of cancer centres have diagnosed or treated well over 6,000 cancer patients across all its services.

Each Rutherford Cancer Centre can treat over 300 patients with proton beam therapy per year. Moreover, each centre also offers conventional cancer treatments and therapies including chemotherapy, immunotherapy and radiotherapy as well as a comprehensive suite of diagnostic services.

Rutherford Health's network of centres is at the forefront of particle therapy and precision radiotherapy research. All Rutherford Cancer Centres are connected on a single IT network, with centralised systems and software, that enables patients to be moved between centres for treatment if for example there is machine downtime in their own centre (which is a common problem for proton centres globally). This is the first such network of proton centres in the world to be centrally connected - making the network one of the most extensive integrated networks of advanced cancer care services.

In addition to the Rutherford's network, the UK National Health Service also operates a proton beam therapy facility at The Christie NHS Foundation Trust in Manchester which became operational in 2019. A second NHS facility is under construction at University College Hospital in London and other independent providers are now trying to establish a presence.

Whilst there was no proton beam therapy provision in the UK before 2018, the NHS has been sending patients who require the treatment abroad for a number of years, either to Germany or the USA. By 2017 the NHS sent a total of 1,149 patients abroad for proton therapy treatment. In early 2021, the NHS revealed that it has provided proton beam therapy treatment to 2,000 UK patients in total, with the majority of them treated abroad.

Our locations



- **Rutherford Cancer Centre South Wales**
Opened March 2017
- **North East**
Opened September 2018
- **Thames Valley**
Opened November 2018
- **North West**
Opened July 2020
- ▲ **Rutherford Clinic Harley Street, London**
- ▲ **Rutherford Clinic Swansea**



Proton Beam Therapy: The Global Market

An increasing number of cancer patients are treated with proton beam therapy throughout the world, often travelling to different countries or cities to access the treatment.

Globally, there has been a steady growth of proton beam therapy treatment in per capita terms. The sharpest growth region has been in the USA. Whilst the population of the USA and Europe are fairly similar in relative terms; 595 million in America and 479 million in Europe; some 31,912 patients received proton beam therapy in the USA in 2019 with only 6,783 patients receiving the treatment in

Europe in the same period according to data published by PTCOG (Particle Therapy Co-Operative Group).

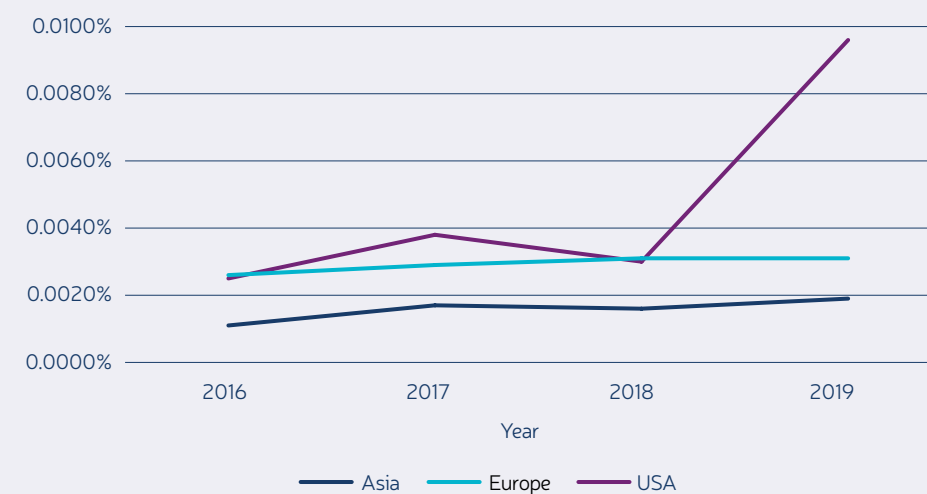
Whilst the US is responsible for the bulk of the growth in proton beam therapy treatment, there has been a steady growth globally and cancer patients from developing nations are often willing to travel for the treatment.

Proton beam therapy: key facts and global growth in numbers:

- The number of patients treated with proton beam therapy per year is expected to increase to over 300,000 patients by 2030.
- By the end of 2020, the size of the global proton beam therapy market by revenue was over \$1 billion (USD) with predicted growth of over \$3.5 billion by 2030.
- There were more than 330 proton beam therapy rooms in the world by the end of 2019 which is expected to grow to over 1,200 by 2030.
- The global proton beam therapy market share is dominated by North America and Europe, which represented approximately 40% and 33% of the market respectively by the end of 2020 in terms of treatment capacity – followed by Asia Pacific region at just under 20% according to data from PTCOG.
- The majority of proton beam therapy facilities are single room facilities, which account for 68% of all facilities as of 2020 with the remainder being multi-room facilities.

The global growth of proton beam therapy on a per capita basis is highlighted in the graph below:

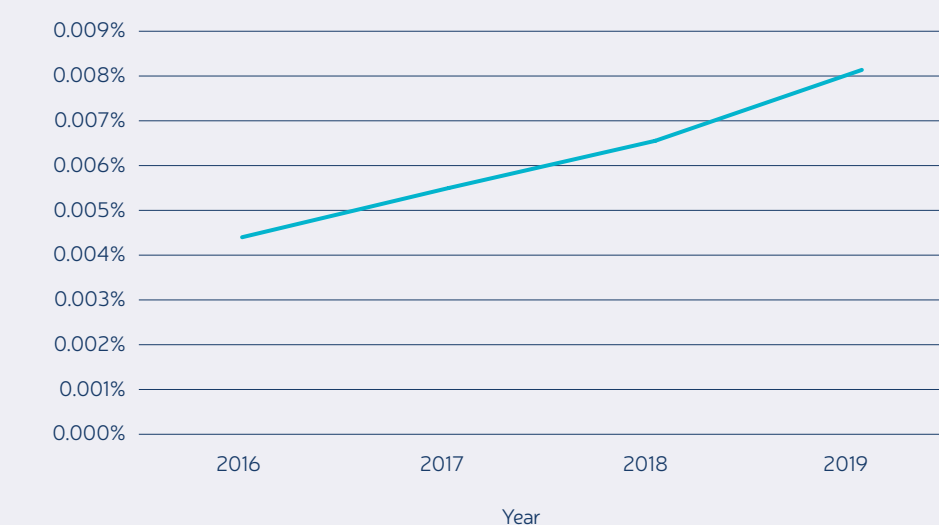
Percentage of PBT carried out per Capita



Source: PTCOG patient statistics per end of 2015, 2016, 2017, 2018 and 2019

The graph below shows the per capita growth of proton beam therapy globally:

Percentage of cancer receiving PBT



Source: GICR cancer incidence statistics compared against PTCOG patient statistics per end of 2015, 2016, 2017, 2018 and 2019



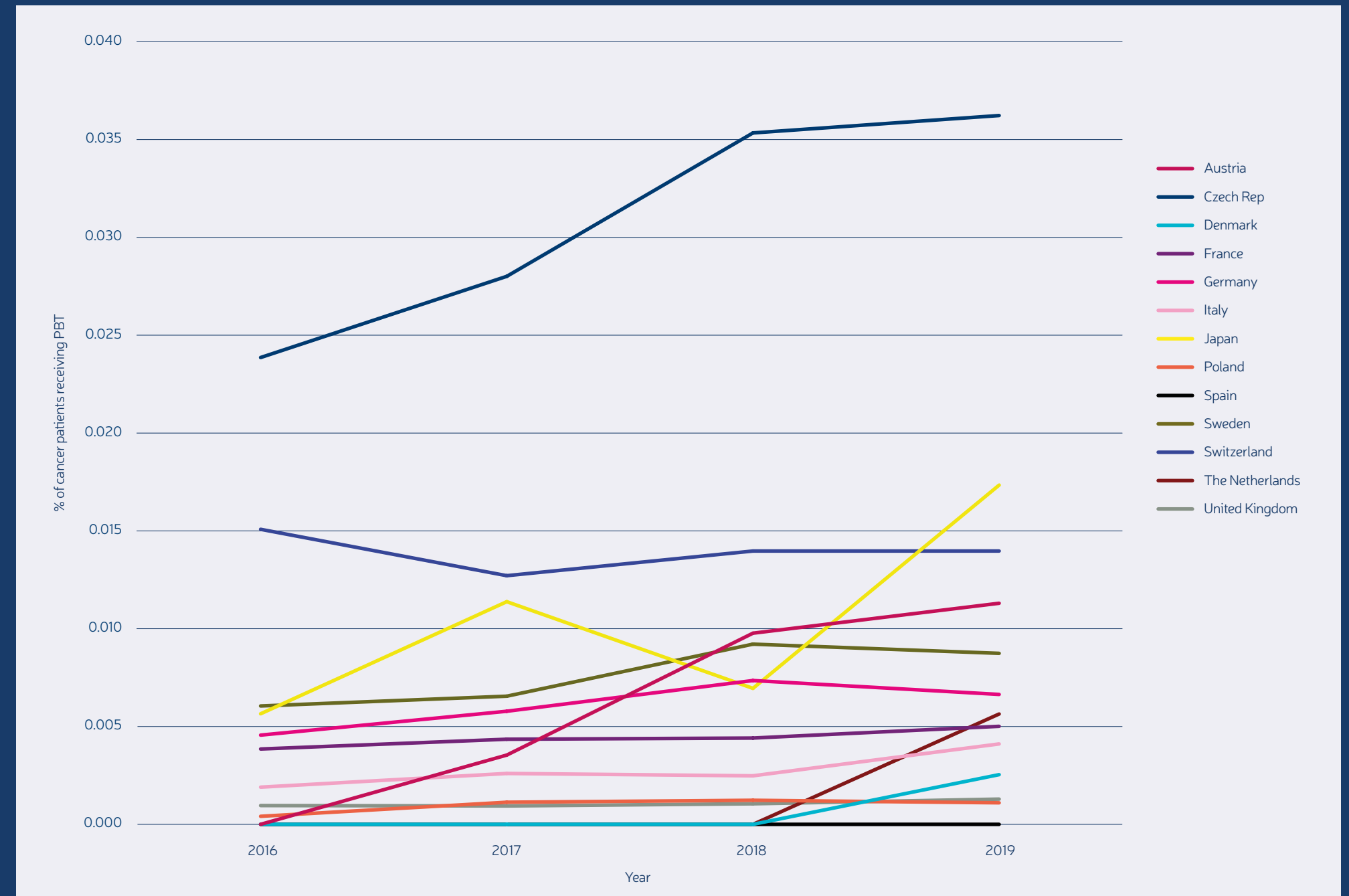
Proton Beam Therapy in Europe

Europe is one of the largest proton beam therapy markets in the world and has seen consistent growth in the provision of the treatment in recent years. The centre at Prague, Czech Republic has historically been a leading provider of proton beam therapy services, with cancer patients from other European countries often travelling to the country for proton therapy treatment.

Other countries have seen significant growth over the past two years in particular, such as the UK which has seen three new centres begin treating with protons since the start of 2019.

Europe by Country (the list also includes Japan):

Calculated percentage of patients receiving PBT



Source: GICR cancer incidence statistics compared with PTCOG patient statistics per end of 2015, 2016, 2017, 2018 and 2019



Why Proton Beam Therapy is so important?

Whilst incidence of cancer continues to increase, patients are living much longer. The average length of survival from cancer has doubled over the past 40 years and over half the population diagnosed with cancer in England and Wales survive their cancers for 10 years or more. This has placed greater emphasis on the need to develop cancer therapies which can reduce side effects and chances of cancer recurrence and, in particular, improve quality of life.

High energy proton beam therapy has emerged as an excellent treatment for a range of cancers whilst offering patients the prospect of living a good quality of life with little to no side effects. In recent years, the number of indications that can be treated with proton beam therapy has increased significantly, offering more cancer patients the option of proton beam therapy.

Paediatric cancers are another key reason why proton beam therapy is so important to improving patient outcomes. Conventional radiation therapies come with heightened risks for paediatric patients, in large part due to the fact that their organs such as bones are still growing and their brains are still developing. Radiation can cause long term side effects and increase the chances of cancer recurrence. This is particularly the case for cancers which are close to the spinal cord and sensitive organs such as the brain.

Proton beam therapy is by no means a panacea for all cancers. At the Rutherford Cancer Centres, each patient is assessed by a multi-disciplinary team, using a 'dual planning' process if necessary, to determine what is the optimum treatment. In many cases, conventional radiotherapy will produce an excellent outcome.



Proton Beam Therapy: Indications, eligibility and anatomical sites

There are three main categories of treatment where proton beam therapy can be beneficial to patients.

1. Absolute indications:
Mainly the majority of children and young adults with a wide range of cancers. Patients of all ages with spinal, paraspinal and skull base tumours.

2. Cancer types where a significant proportion of patients are likely to benefit:
Lung, breast (breast patients who need treatment to the internal mammary chain of lymph nodes – left or right), head and neck, brain, CNS (central nervous system), lymphoma, sarcoma and oesophageal through reduced long-term side effects.

3. Patients where the anatomy of the tumour and critical normal tissues favours a dose distribution with protons:
This could be of any cancer type or site where radical radiotherapy is being proposed. That means the radiation is being given with the aim of eradicating the cancer, so curing the patient. To determine whether protons will be indicated, it will be necessary to develop the proton and photon plans and conduct a comparative analysis of the dose volume histogram carried out manually, or by computer scoring to determine which treatment method would give the best results in terms of side effect reduction. This will require the development of normal tissue complication probability (NTCP) models which are applied to each patient to calculate their individual change in NTCP (NTCP). This represents the difference between proton and photon treatments to different organs at risk, allowing an assessment of the likely benefits in terms of reduction in the risk or severity of clinically relevant side effects. This approach was pioneered in the Netherlands and is referred to as the Dutch Model Based Approach.

Creating two-model plans to determine whether or not to use proton beam therapy is known as ‘dual planning’.

Indications which can be treated with proton beam therapy include:

- Paediatric cancers
- Skull, spinal and para-spinal
- Head and neck
- Brain
- Lung
- Breast
- Genitourinary
- Gastro-intestinal
- Liver
- Pancreatic
- Prostate
- Bladder
- Lymphoma
- Sarcoma
- Re-irradiation

(Re-irradiation is for patients who require a second course of radiotherapy as re-treatment to the same or adjacent area. Proton beam therapy can enable the delivery of the second course by reducing the radiation dose to nearby structures and reducing the overlap with previously treated areas.)



Rutherford Proton Decision System

As the biggest provider of proton beam therapy in the UK and one of the biggest in Europe, Rutherford Health has launched a new 'Decision System' tool for oncologists to get a rough comparison of treatment benefit from protons versus other radiotherapy modalities at the click of a button.

The fully automated modelling system can take diagnostic images and weigh up the dosing advantage to organs at risk within a few hours without the need for a planning CT.

The tool will allow oncologists to upload patient scans to a system that automatically works out whether protons are likely to have any benefit over standard options. This can give oncologists an initial idea, free of charge, of whether it is worth putting a patient forward to formally consider proton beam therapy, which is a much longer clinical process. It also allows oncologists to give faster reassurance to patients agonizing over treatment decisions by cutting days off traditional double planning input time.

The system, called the 'Rutherford Dual Planning System' facilitates best practice among oncologists by making dual planning easy, efficient and inexpensive.

Proton beam therapy is still a relatively new treatment to the UK and clinical staff and the wider public urgently need to be able to compare proton treatment plans with existing forms of radiotherapy. Rutherford's modelling system aims to achieve this and thereby make proton beam therapy more easily accessible for cancer patients who need it.



Further clinical evidence on effectiveness of Protons

Recent years has seen the emergence of more clinical evidence that demonstrates the effectiveness of proton beam therapy over conventional photon radiation.

A 2019 study led by the Perelman School of Medicine at the University of Pennsylvania found that, proton beam therapy leads to significantly lower risk of side effects severe enough to lead to unplanned hospitalisations for cancer patients when compared with traditional radiation, while cure rates between the two groups are almost identical.

The study evaluated data on 1,483 patients, 391 of whom received proton beam therapy and 1,092 who received photon (conventional radiation) treatment. Careful analysis of both patient groups revealed that the risk of side effects from toxicity to the body was two-thirds lower for proton beam therapy patients compared to conventional radiation therapies. Researchers leading the study also highlighted that overall survival rates were similar in both groups, indicating the reduced toxicity with proton beam therapy did not come at the cost of effectiveness. The findings of the study were subsequently published in JAMA Oncology.

Evaluated data on

1,483
patients



Global treatment variations

With the exception of the Rutherford Cancer Centres, dual planning is not yet standard practice in the UK for cancer patients who require radical radiotherapy and indications vary considerably in different countries. In the US, indications for proton beam therapy are more expansive than the UK and Europe and availability of proton therapy facilities is greater still. About 23% of radical radiotherapy patients are deemed to be eligible to receive proton beam therapy in the US.

In some countries in Europe, the figure is between 10-15%. In the UK, NHS estimates on the utilisation of proton therapy for radical radiotherapy patients is 1%. This is considerably lower than the majority of countries in the Western world. In recent years, indications have been gradually expanding in the UK and the NHS is conducting the 'Torpedo' trial – a large trial that will assess the effectiveness of protons for head and neck cancers. This could significantly expand proton indications.

IBA, one of the world's leading manufacturer of proton beam therapy systems which have treated over 100,000 patients with proton beam therapy, estimates that the treatment can be used in 20% of radical radiotherapy patients. IBA's stated mission is to make proton therapy available through partners for all patients that might benefit from it.

The USA and Central European countries treat a wider range of indications than the UK.

Below is a summary of some of the most treated indications with proton beam therapy in the USA and Europe. Paediatric cancers remain the most widely accepted indication for proton beam therapy in both the USA and Europe.

- Prostate cancer is the most treated indication with proton beam therapy in the USA; accounting for 22% of proton treatment in the country.
- In Europe, eye cancers are the most treated indication with protons; although this is predominantly low energy proton beam therapy. The most treated indication with high energy protons is also prostate cancer which accounts for 16% of proton therapy treatment in Europe.
- Paediatric and head and neck cancers are the second and third most treated indications in the USA, accounting for 18% and 11% of all proton beam therapy treatment in the country respectively.
- Central nervous system and Paediatric cancers are the second and third most treated indications in Europe, accounting for 16% and 15% of all proton beam therapy treatment in Europe respectively.
- Head and neck cancers account for 9% of proton beam therapy in Europe and cancers of the central nervous system account for 7% of proton beam therapy in the USA.



The benefits and potential of Proton Beam Therapy



a growing number of insurance providers have increasingly recognised the benefits and long-term cost effectiveness of the treatment

Cost effectiveness and quality of life

Proton beam therapy can be cost-effective, in particular over the longer term. Treatment with proton beam therapy means patients will generally require less additional care than treatments which are often associated with conventional radiation therapies.

Paying for proton beam therapy

The very significant investment required to introduce proton beam therapy into the UK, meant that initially the cost of treatment was considerable. Over time however, thanks to technological developments, new treatment techniques and widespread construction of treatment facilities, there has been a substantial reduction in cost.

When considering the cost of proton beam therapy compared to conventional radiotherapy, several factors should be taken into account.

Although treatment for cancer on the NHS in the UK is free at the point of delivery, the reality is that there is still a cost within the system. The average cost of radiotherapy is estimated to be between £15,000 to £40,000.

Proton beam therapy varies significantly in cost depending on the indication and number of fractions delivered (the number of sessions in the treatment programme). Prices start at £20,000 and can exceed £100,000, with brain and paediatric cancers typically more expensive. However, when comparing this to expensive drug costs and other treatments, such as CAR T and immunotherapy, proton beam therapy is a value proposition.

Proton beam therapy is not necessarily the most appropriate treatment particularly in non-organ indications. Best practice is comprehensive dual planning to determine whether proton beam therapy is more suitable than other radiotherapy options.

Insurance providers in the UK are now increasingly likely to cover proton beam therapy for head and neck cancers, brain cancers, sarcomas, lymphomas and selected patients with breast cancer requiring irradiation of the internal mammary node chain.

The changing attitudes towards proton beam therapy among insurers can partly be attributed to consumer

demand, but healthcare professionals are now also seeing anecdotal and tangible evidence, through their patients' personal accounts of experiencing little to no side-effects following proton beam therapy. For insurers, the absence of ongoing side-effects clearly makes it a cost-effective proposition for the long-term. However, they are also recognising how transformative the treatment is for a patient's quality of life, especially for those with complex cancers such as those in the head and neck.

This has been the experience of Rutherford Health where a growing number of insurance providers have increasingly recognised the benefits and long-term cost effectiveness of the treatment. The robust clinical governance, evidence-based assessments, double planning and independent decision-making that are in place at Rutherford Health has also given insurers the confidence and evidence they need to cover proton beam therapy for their patients.

Another key factor for the change in attitude to proton beam therapy is the significant reduction in cost over recent years. The cost reduction can be attributed to several factors: The widespread construction of facilities

which has created the critical scale needed for initial expenditure to reduce; technological development and the wider use of single-room proton beam therapy systems; and new treatment techniques which can administer protons at tumour sites with considerably fewer fractions whilst delivering the biologically equivalent dose. Also, other advanced treatments such as immunotherapy are now more expensive than proton beam therapy and the cost difference compared with conventional radiotherapy is getting narrower.

Whereas initially there was some hesitancy from insurers to offer their customers proton beam therapy due to the higher cost compared to conventional radiotherapy, Rutherford Health has seen a definite and positive shift in attitude from the larger insurance groups.

Each cancer case is reviewed by insurers on a case-by-case basis and as the benefits of proton beam therapy becomes more apparent and costs decline further, proton beam therapy becomes more compelling from a clinical, financial and quality-of-life standpoint. It also means the number of indications covered by insurers with proton beam therapy is highly likely to increase in coming years.



Rutherford Health's oncologist training programme

Rutherford Health has designed a bespoke course in collaboration with IBA and Penn Medicine to train UK clinical oncologists in planning and supervising high energy proton beam therapy for cancer patients.

Over 35 oncologists have become certified in proton beam therapy through the programme since it started. The programme has since been expanded to meet rising demand and a further 20 clinical oncologists have been enrolled onto the programme in the first half of 2021.

The two-part programme involves an e-learning module hosted on the OncoLink® website delivered by IBA Worldwide followed by a course with Penn Medicine which is currently done virtually due to the pandemic. The course takes two weeks to complete depending on the flexibility of trainee oncologists. Following the initial training there is a series of disease-specific educational updates covering a full range of disease sites.

The Rutherford oncologist training programme will have a positive impact on access to proton beam therapy for significantly more patients in the UK. The geographical spread of Rutherford Cancer Centres means that oncologists from across the UK can offer this treatment in their local centre, rather than send patients to Manchester for treatment in the NHS centre.



Patient experiences

Below are the stories of two patients who were treated at the Rutherford Cancer Centre South Wales for different cancers. Both have been free of cancer since completing their treatments two years ago and have been living a normal life with no side effects despite having cancers which came with a high risk of side effects if treated with conventional treatments.

“

... I later read research from the United States that prostate patients were suffering fewer side effects following proton beam therapy, it re-affirmed the decision that I made

- Timon



Read the stories



› Timon's story



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...I was impressed by the potential of reduced side effects of proton beam therapy and decided to go ahead and undertake the treatment

Timon Colegrove, who lives in Oxfordshire, was diagnosed with prostate cancer in 2018, following a full medical check.

He was in his mid-50s at the time of his diagnosis, symptomless (and so clueless as to being ill) and otherwise fit and healthy. He was alarmed by the potential side effects of existing treatments for prostate cancer, in particular the 40% risk of impotence and incontinence following treatment. He was determined to find another way and began researching advanced cancer therapies which led him to proton beam therapy.

Timon, now 60, says: “When I was diagnosed, it came as a complete shock and the various options for treatment laid in front of me all seemed rather grim.

“I decided to research proton beam therapy after hearing about it at my local prostate cancer support group. I was impressed by the potential of reduced side effects of proton beam therapy and decided to go ahead and undertake the treatment.

“I was scheduled for 20 fractions which took a month to administer. There was no pain and I didn't feel anything. It was over before I knew it.

“Many men are suffering dreadfully because of the side effects of the usual prostate cancer treatments and for a sizeable proportion of these men the treatment side effects could be significantly reduced or as in my case avoided in entirety. I feel obliged to share my journey to spread the word that for some men, they may have a choice. Men have a right-to-know that there may be an alternative to the brutality of surgery and the conventional radiotherapies. Of course, each patient must be treated according to their particular cancer and when I later read research from the United States that prostate patients were suffering fewer side effects following proton beam therapy, it re-affirmed the decision that I made.

“Not enough prostate cancer sufferers are aware of this treatment choice. They need to know that there might be an alternative treatment choice for them that can not only address the cancer but also allow them to lead a life without having to deal with the daily distress of incontinence and impotence.”

Timon lives with his wife Rebecca and has been cancer-free for two years. He has started an initiative called ‘Men are Talking’ to raise awareness and get men to talk more openly about prostate cancer and the terrible life changing experience it can have - both as a side effect of treatment and from it reaching an advanced stage. He delivers talks in his free time to businesses and cancer charities to raise awareness of proton beam therapy as a superior treatment for prostate cancer.



➤ Ryan's story



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The process of undergoing
proton beam therapy was much
better than anticipated

Ryan Scott, from Wales, was diagnosed with a brain tumour (grade 1 craniopharyngioma) and was one of the first patients in the UK to receive high-energy proton beam therapy.

Ryan was initially diagnosed and treated with NHS Wales and became one of the first to benefit from an agreement between Rutherford Health and the Welsh government that allowed cancer patients in Wales to receive proton beam therapy at the Rutherford Centre in South Wales.

Ryan, 25, says: “I had been through a number of operations to treat my tumour. It was great to see this treatment becoming available in the UK. I was very pleased when my consultant recommended proton beam therapy and told me that it was available close to home in South Wales.

“I had been due to be treated with proton beam therapy over the course of eight weeks in the United States, a disruption I was not looking forward to. A four-hour round trip to South Wales for eight weeks was a small price to pay given the alternative was going abroad.

“The process of undergoing proton beam therapy was much better than anticipated and I felt relieved that I had been selected for this treatment over conventional radiotherapy. There have been hardly any side effects and being able to sleep in my bed after a day's treatment was a real plus. The treatment made such a difference to me and my life. I had no side effects such as hair loss and I have the Rutherford and NHS Wales to thank for that. The staff at the Rutherford were absolutely amazing. I entered the facility as a patient and left as a friend.”

It's been two years since Ryan was treated with proton beam therapy for his brain tumour and he has been tumour free since and has been able to return to work as a carpenter. Ryan added: “I am now 90% back to my normal self, I still get very tired on occasions due to the location of the tumour on the pituitary but I have been able to return to my normal life and get back to work and spend time with my dog Jody. I got Jody two weeks before I was diagnosed so missed much of her growing up as a puppy.”

Besides being a carpenter, Ryan spends his spare time with his dog Jody on his campervan which he built during the Covid-19 lockdown with his father.

