

International Strategic Review Particle Therapy Workshop

CP4CT Workshop, London 27.02.2026

Increasing global access to radiotherapy

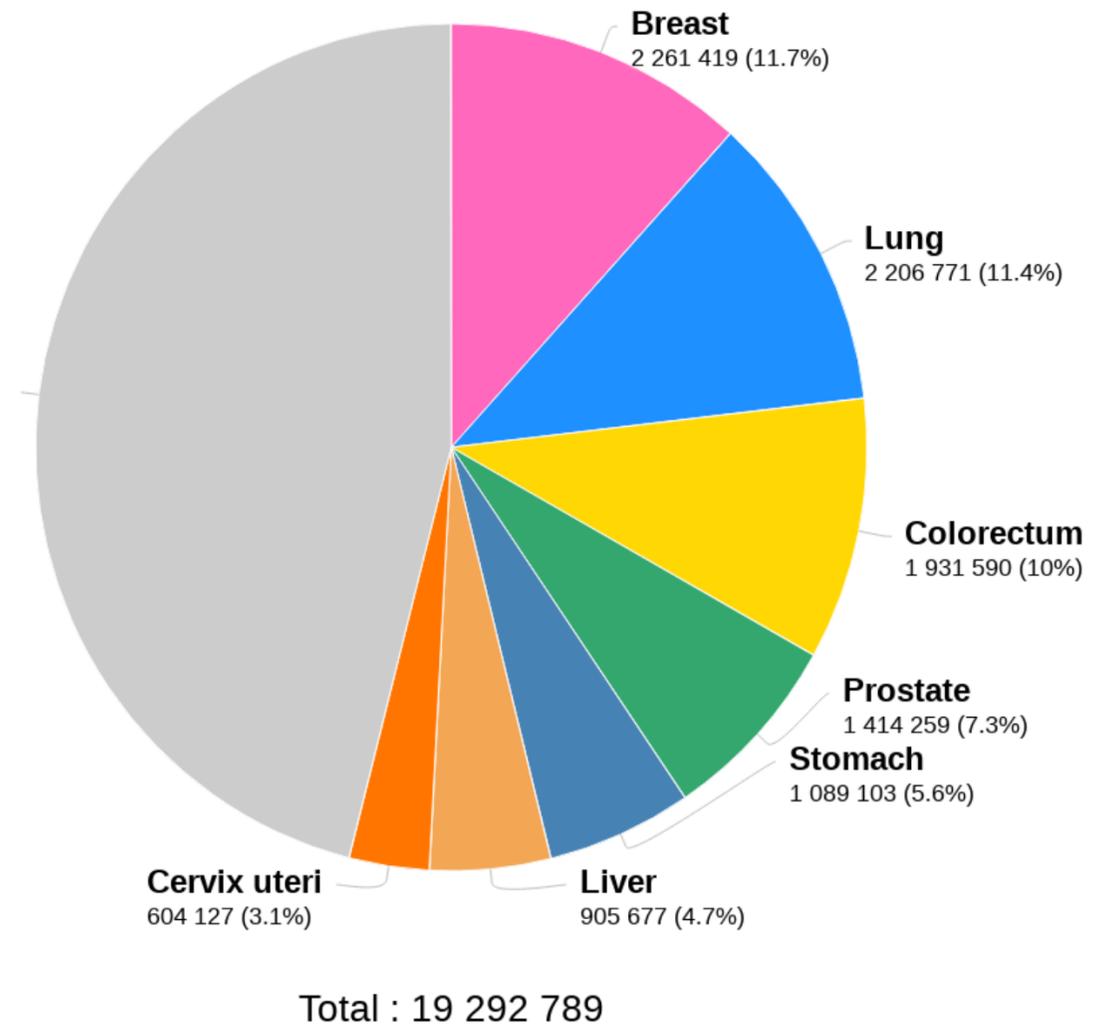
Manjit Dosanjh,

University of Oxford, ENLIGHT and STELLA project



Cancer is a growing global challenge

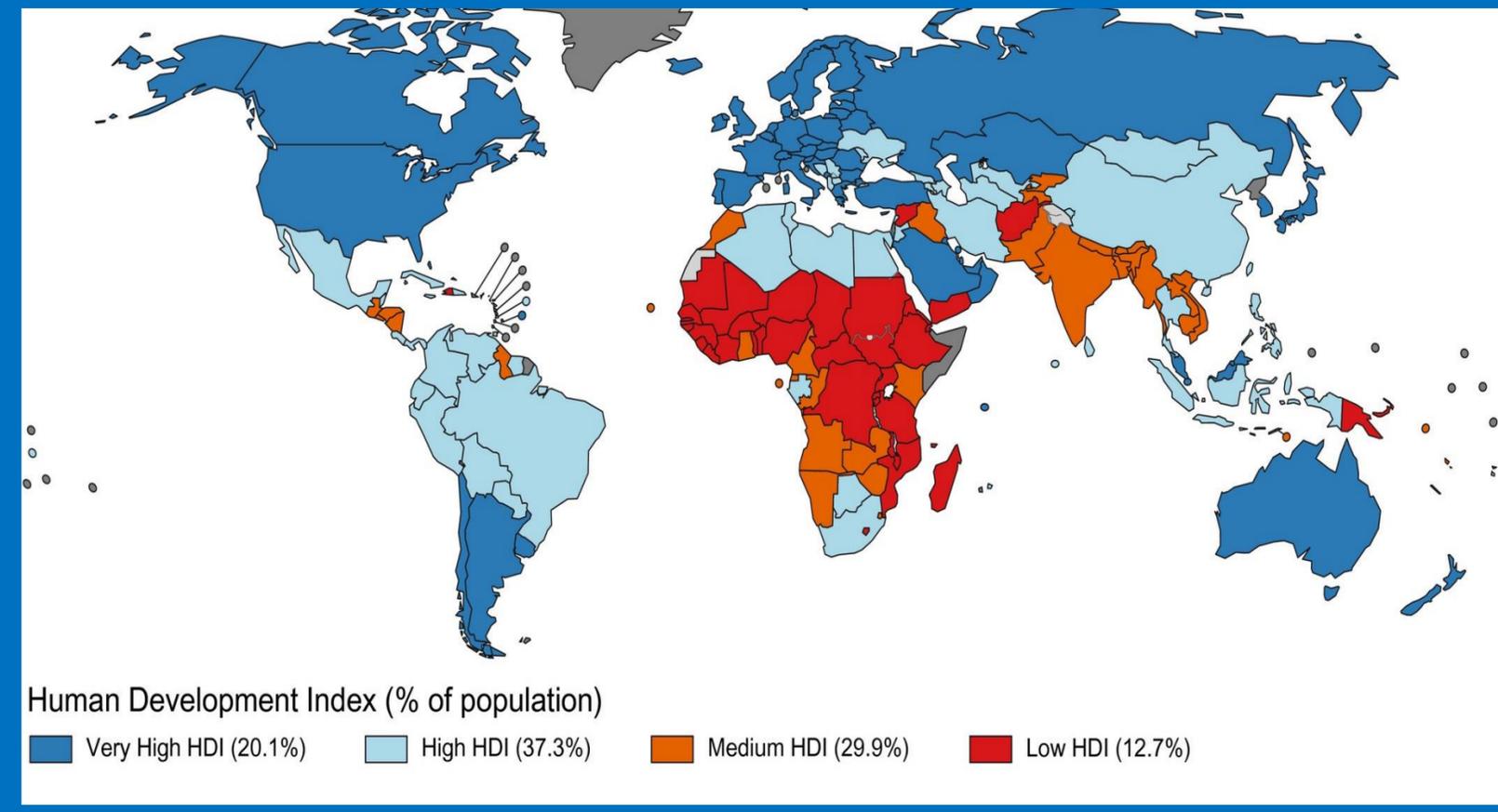
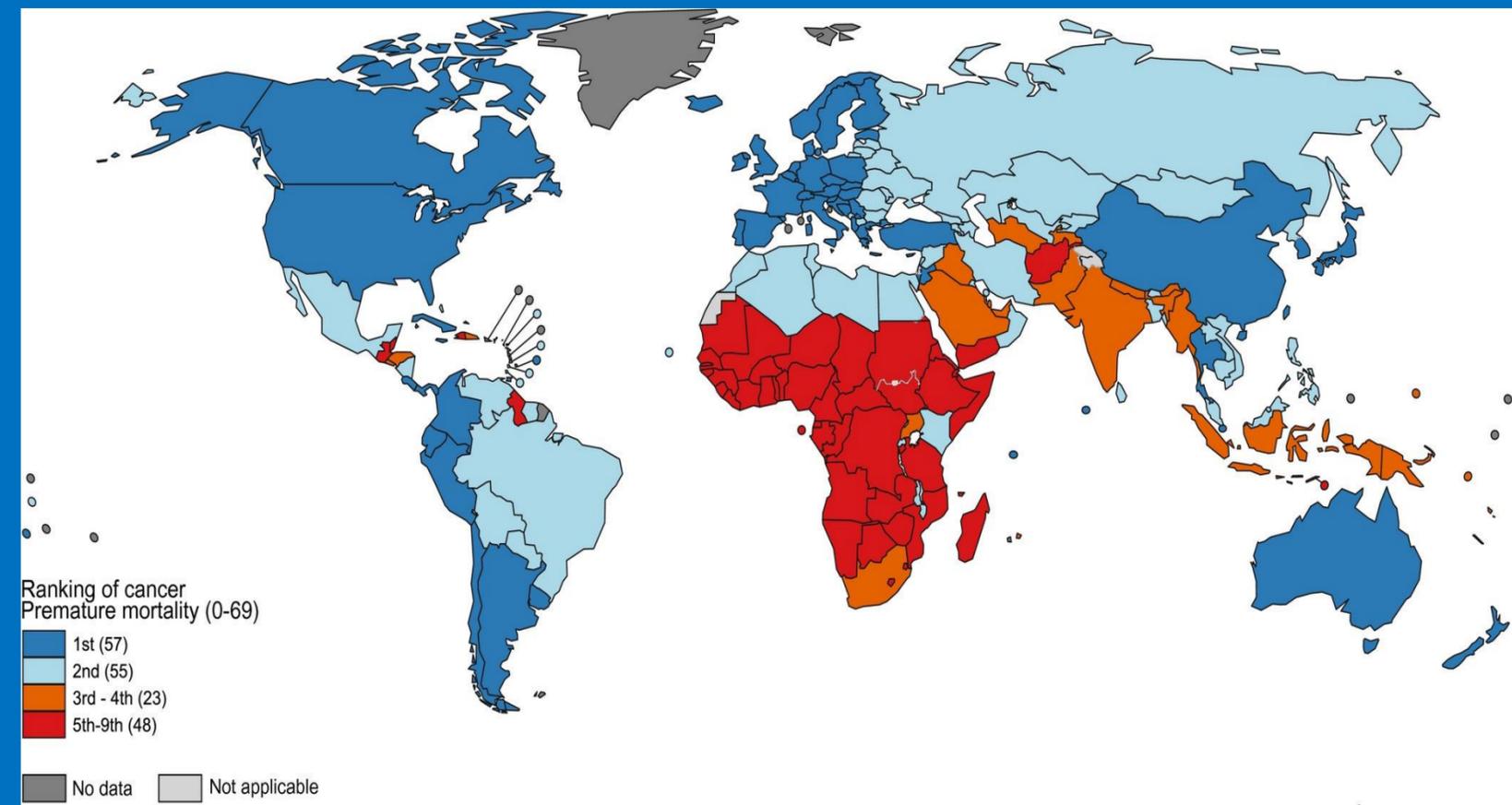
- In 2022 globally **20** million new cases per year diagnosed and **10** million deaths
- By 2050 this will increase to **35** million new cases per year and **16.3** million deaths
- The impact of this increase is not felt evenly across countries.
- Those who have the fewest resources to manage their cancer burdens bear the brunt of the global cancer burden



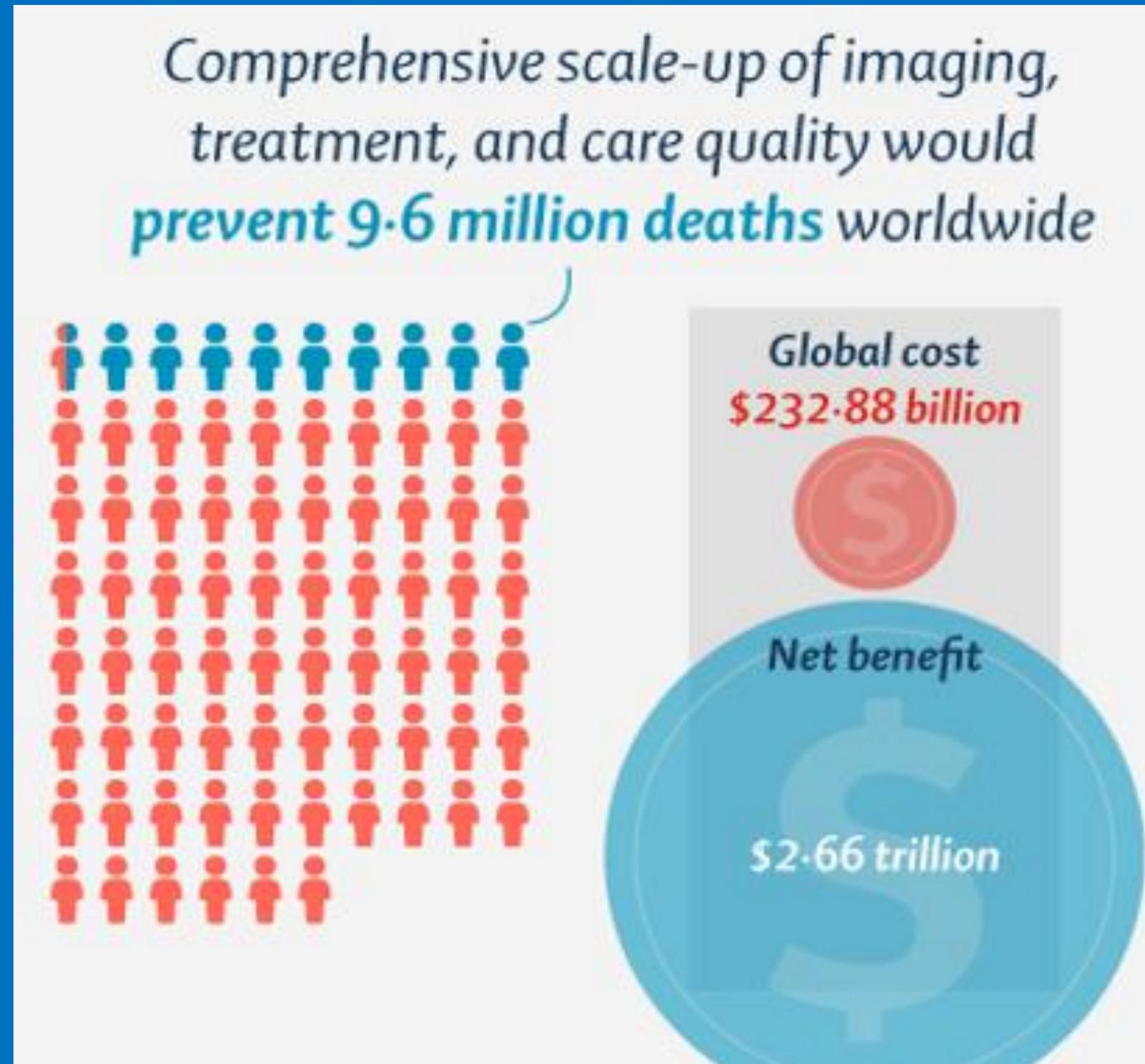
Data source: GLOBOSCAN 2020

Radiation therapy is a key tool for treatment for 50-60% patients

Mortality of Cancer and HDI (Human Development Index)



Investment in RT Equipment and related needs and expertise



ENLIGHT (European Network for Light Ion Hadron Therapy)

The idea germinated in 2001 during an ESTRO- Med-AUSTRON meeting where PIMMS was presented

ESTRO HT group was established for creating a joint platform covering the different aspects of hadron/particle therapy and projects in Europe which should lead to a collaboration and help access

In October 2001 the proposal for a Thematic Network was submitted to EC and Funded for 1 million Euros in 2002

ENLIGHT was launched In February 2002 at CERN

Driving Force:

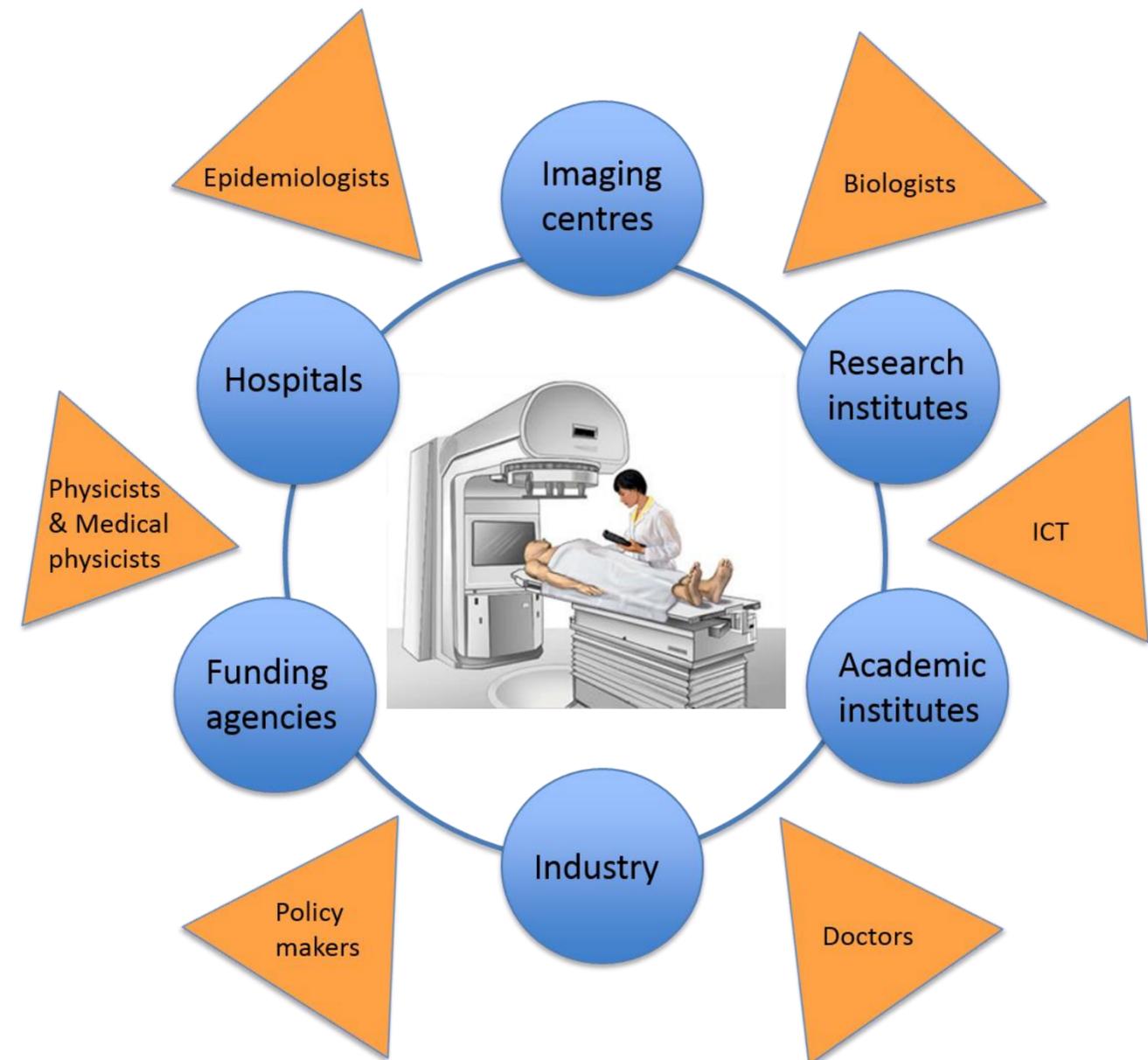
ESTRO (Jean Pierre Gerard, Germane Heeren)

CERN (Ugo Amaldi, Hans Hoffmann, Manjit Dosanjh)



ENLIGHT: European Network for Light Ion Hadron Therapy

- Create a common multidisciplinary platform for cancer
- Bring together a wide and diverse range of need and interest
- Identify challenges
- Share knowledge
- Share best practices
- Harmonise data
- Provide training, education
- Innovate to improve
- Lobbying for funding
- Increase access



Facilities in operation in Europe (2002)



Source: PTCOG, June 2014

EC funding: building the community



Total funding of 24,6 M Euros



2008-2012

- Marie Curie Initial Training Network
- 12 institutions
- 29 trainees



2009-2014

- Infrastructures for hadron therapy
- 20 institutions



2010-2014

- R&D on medical imaging for hadron therapy
- 16 institutions



2011-2015

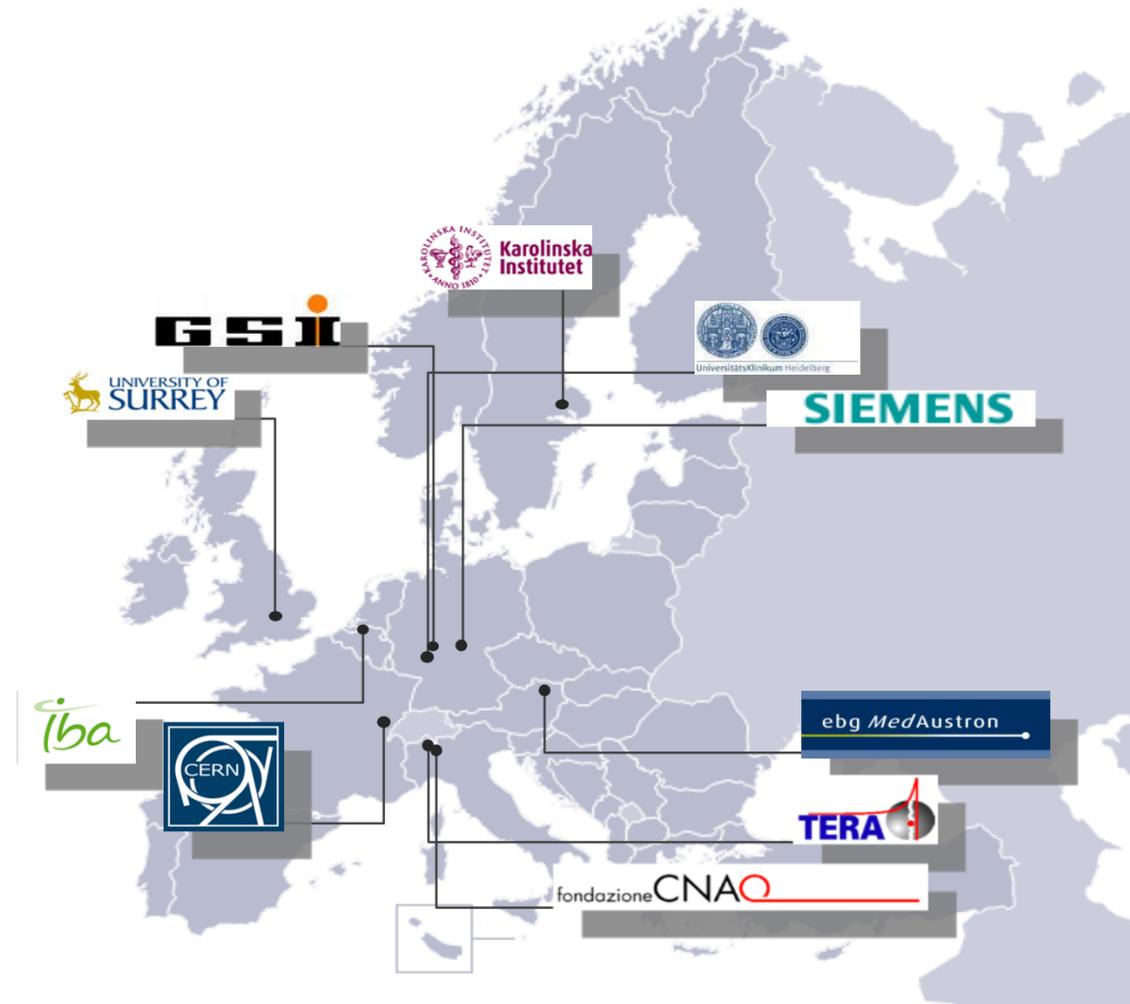
- Marie Curie ITN
- 12 institutions
- 16 trainees

Prompt γ (gamma) camera, prototyped, now commercial

Chosen as Gold project

PARTNER – training the future experts in particle therapy

- Particle Training Network for European Hadrontherapy
- 10 academic institutes, research centres, 2 leading companies
- 29 young researchers

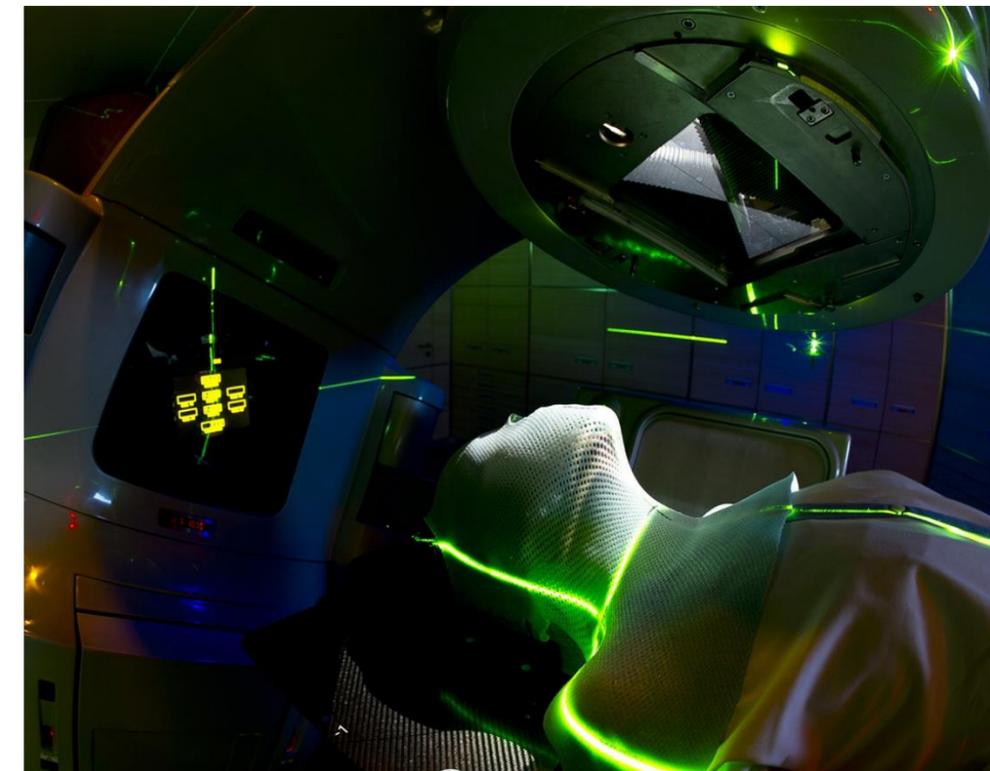


- Now working around the World
- Leaders in the field particle therapy

European Novel Imaging Systems for Ion Therapy

**Accurate positioning is a crucial challenge
for targeting moving organs during particle treatment**

- 4-year EU funded project: Budget 6M euros
- launched in February 2010
- 16 leading European research centres and industrial partners, coordinated by CERN
- R&D in real-time medical imaging for more precise and effective particle therapy
 - 2 demonstrators for real time imaging have been constructed and are being tested
 - > 100 scientific publications and 80 conference talks/posters





Union of Light Ion Centre in Europe



ULICE



- **Transnational access** to beam time at HIT and CNAO successfully implemented
- **Joint research activities:** New gantry design being finalized
- **Networking Training courses at HIT and CNAO**
 - For physicians and physicists already working in hadron therapy
 - For physicians, physicists, biologists who want beam time for their experiments

HITRIplus Consortium (started April 2021)

H2020-INFRAIA-2018-2020

23 Institutes

(4 CIRT centres, 11 research institutions, 5 universities, 3 SMEs)

14 European Countries

4.5 years Project

(1st April 2021 – 30th September 2025)

Total budget: 5 MEuro

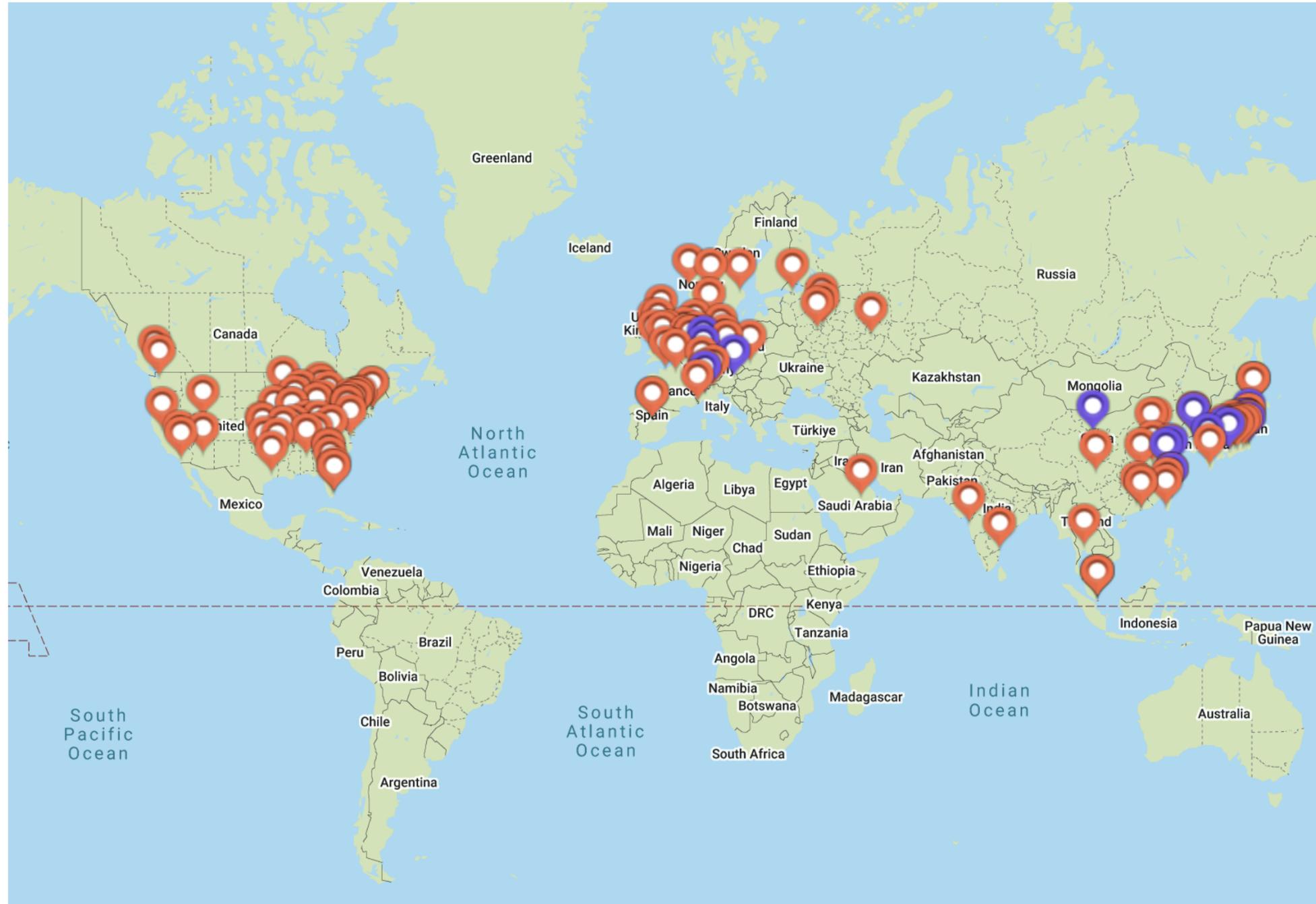


CYCLHAD

CYCLOTRONS POUR L'HADRONTHÉRAPIE



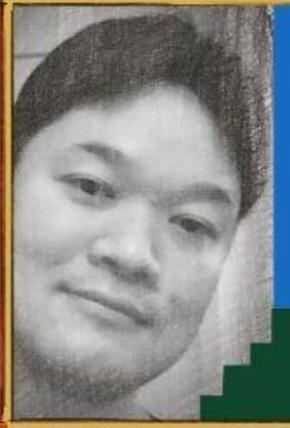
Particle Therapy facilities in clinical operation in 2026



Proton facilities (in red) and carbon therapy facilities (in blue)

PTCOG, 2026

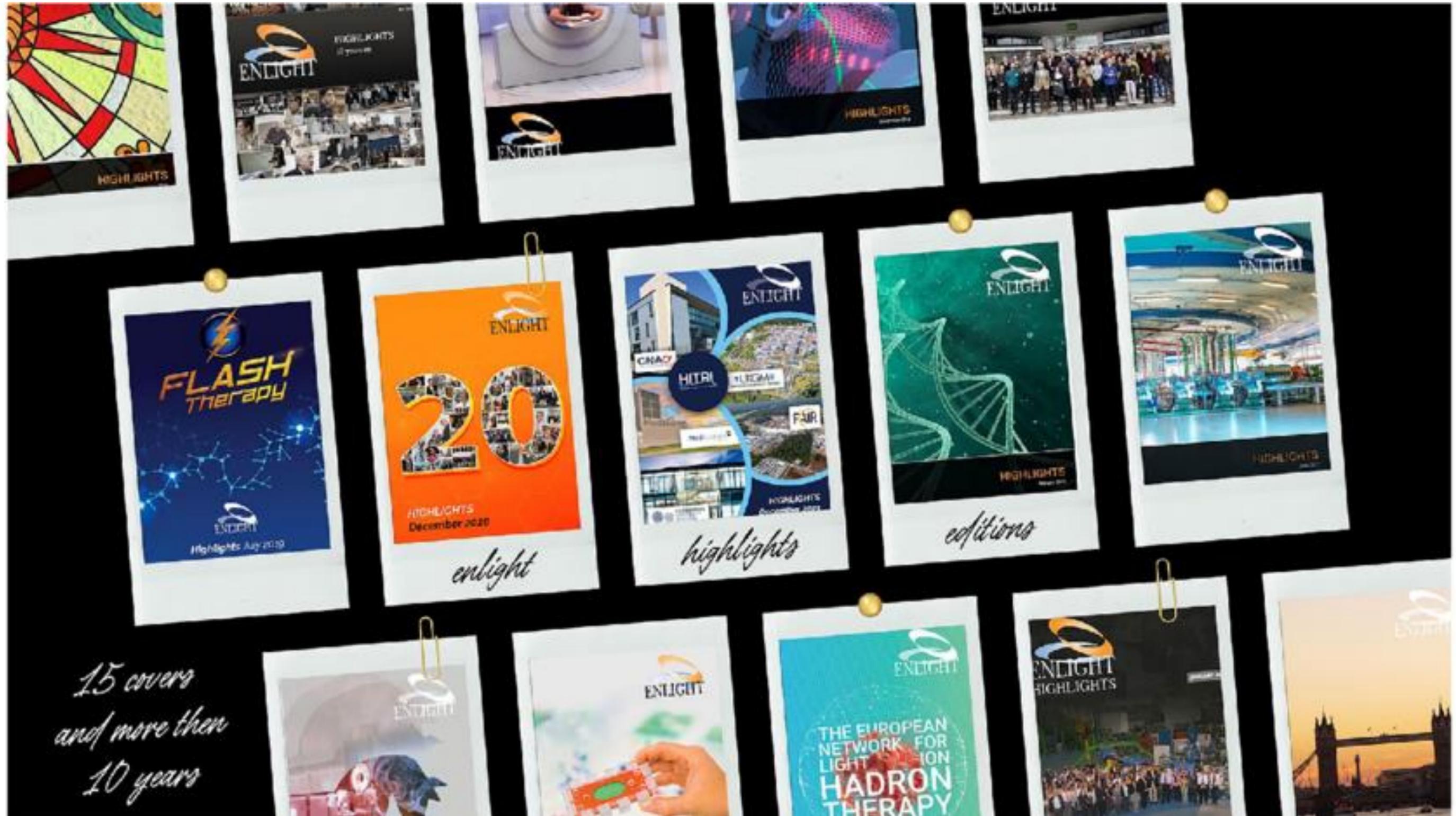
Currently around 120 proton and 17 carbon facilities. Just over 400,000 patients have been treated so far, of which around 60,000 with carbon.

 <p>SANDRO ROSSI GENERAL DIRECTOR OF CNAO</p>	 <p>ESTER ORLANDI CHIEF OF THE CLINICAL DEPARTMENT, CNAO</p>	 <p>KLEMENS ZINK SCIENTIFIC AND TECHNICAL DIRECTOR, MIT</p>	 <p>ULRIKE SCHÖTZ HEAD OF MOLECULAR RADIOBIOLOGY, RADIOTHERAPY DEPARTMENT, PHILIPPS-UNIVERSITÄT MARBURG</p>	
 <p>KILIAN-SIMON BAUMANN MEDICAL PHYSICIST, MIT POSTDOC, PHILIPPS-UNIVERSITÄT MARBURG</p>	 <p>THOMAS HABERER SCIENTIFIC & TECHNICAL DIRECTOR AT THE HEIDELBERG ION BEAM THERAPY CENTER</p>	 <p>PIERO FOSSATI SCIENTIFIC DIRECTOR, CARBON IONS PROGRAM DIRECTOR</p>	 <p>INSA SCHRÖDER GROUP LEADER STEM CELL DIFFERENTIATION, CYTOGENETICS GROUP, BIOPHYSICS DEPARTMENT, GSI</p>	
 <p>FELIPE CALVO DIRECTOR OF THE PROTON THERAPY UNIT, CLINICA UNIVERSIDAD DE NAVARRA</p>	 <p>NORIYUKI OKONOJI CHIEF PHYSICIAN FOR THE DEPARTMENT OF CHARGED PARTICLE THERAPY RESEARCH AT THE NATIONAL INSTITUTE FOR QUANTUM SCIENCES AND TECHNOLOGY, QST HOSPITAL</p>	  <p>WALTER TINGANELLI CLINICAL RADIOBIOLOGY GROUP LEADER, BIOPHYSICS DEPARTMENT GSI</p> <p>EMANUELE SCIFONI EXPERIENCED SENIOR RESEARCHER TIFPA</p>	 <p>SEMI HARRABI RADIATION ONCOLOGY UNIVERSITY HOSPITAL HEIDELBERG</p>	 <p>THOMAS TESSONNIER MEDICAL PHYSICIST AND RESEARCHER, HIT</p>
 <p>ANDREA MAIRANI SENIOR PHYSICIST, HIT</p>	 <p>STEPHEN MYERS EXECUTIVE CHAIR ADAM SA EXECUTIVE DIRECTOR AVO PLC</p>	 <p>ALBERTO DEGIOVANNI DEPUTY TECHNICAL DIRECTOR, GROUP LEADER FOR ACCELERATOR PHYSICS AT AVO-A.D.A.M, MEYERIN SWITZERLAND</p>	 <p>ANNA MARIA KOLANO PHD, MEDICAL PHYSICIST, AVO-A.D.A.M, MEYERIN, SWITZERLAND</p>	 <p>MAURIZIO VRETENAR PROJECT LEADER, CERN</p>

- **SUCCESSFUL SEMINARS SINCE JUNE 2021**
- **100-150 PARTICIPANTS EACH TIME**

HITRIPLUS SEMINARS

ENLIGHT HIGHLIGHTS



ENLIGHT 2012, 10th Anniversary-launch of ENLIGHT Highlights 14-16th September, CNAO, Pavia



In front of the CNAO facility

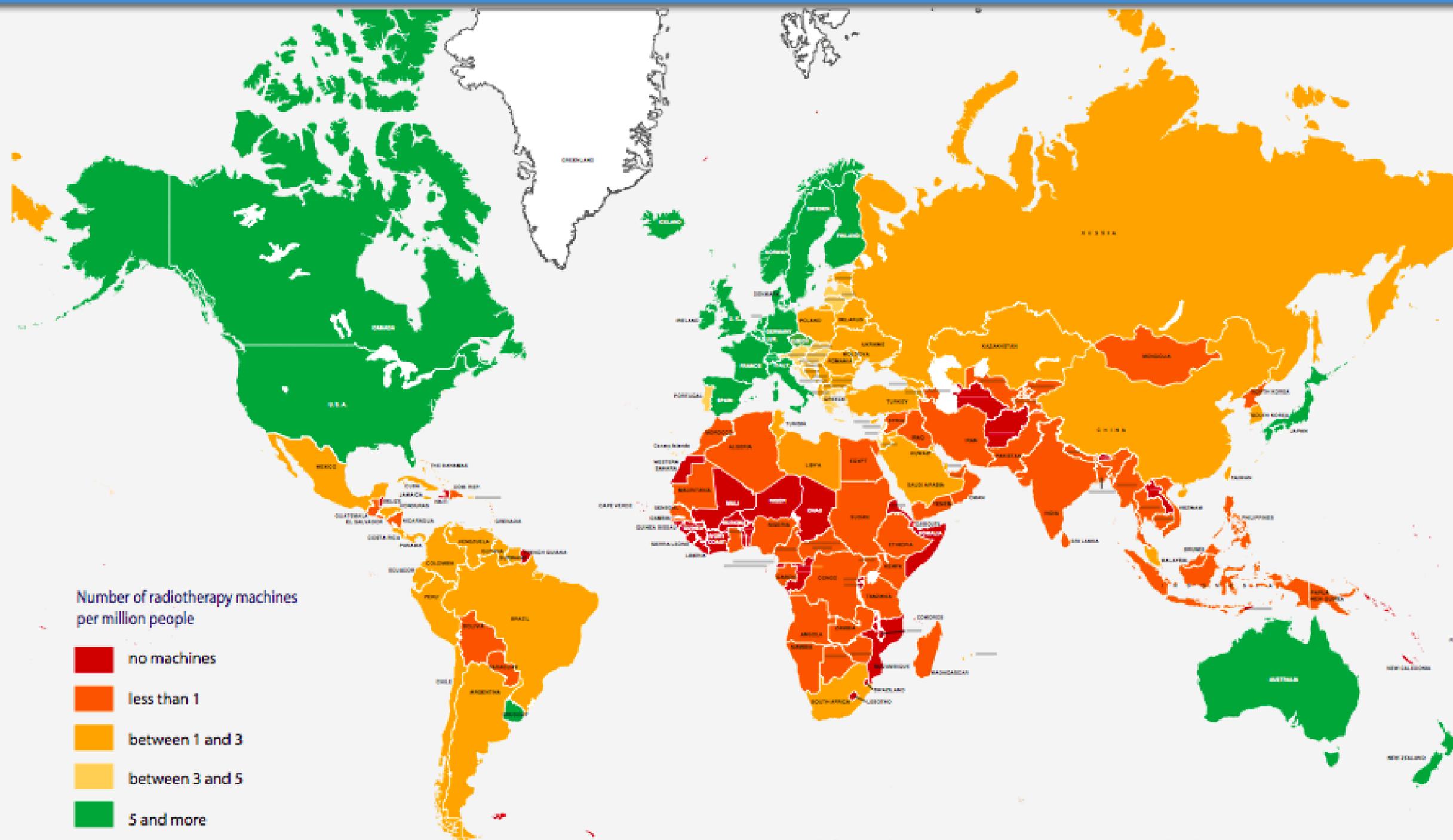


In front of the first cover of ENLIGHT Highlights

Availability of RADIATION THERAPY

Number of Radiotherapy Machines per Million People

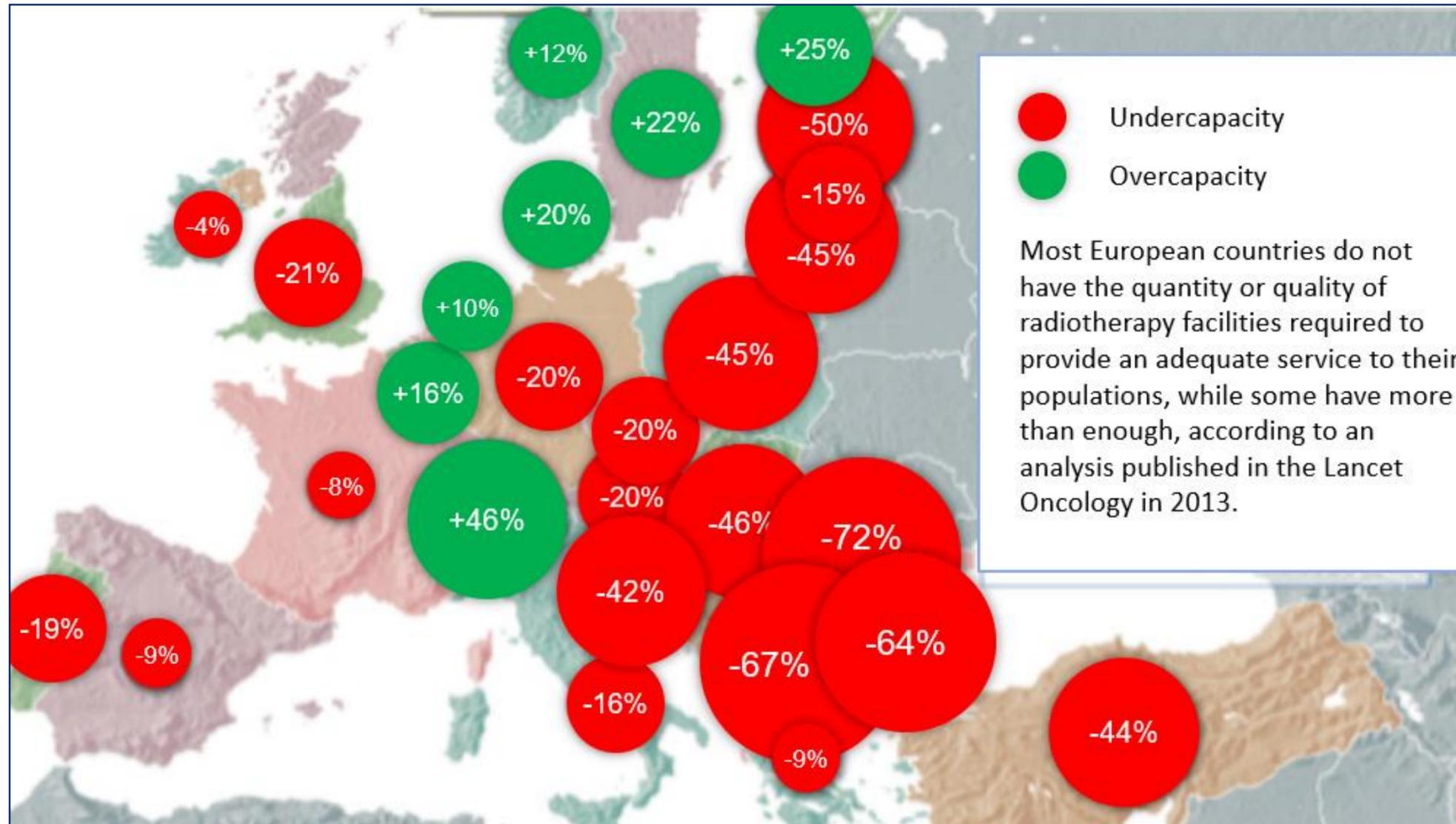
IAEA, 2012



Source: DIRAC (Directory of Radiotherapy Centres), 2012 / IAEA

For more information: <http://www-naweb.iaea.org/nahu/dirac/>
dirac@iaea.org

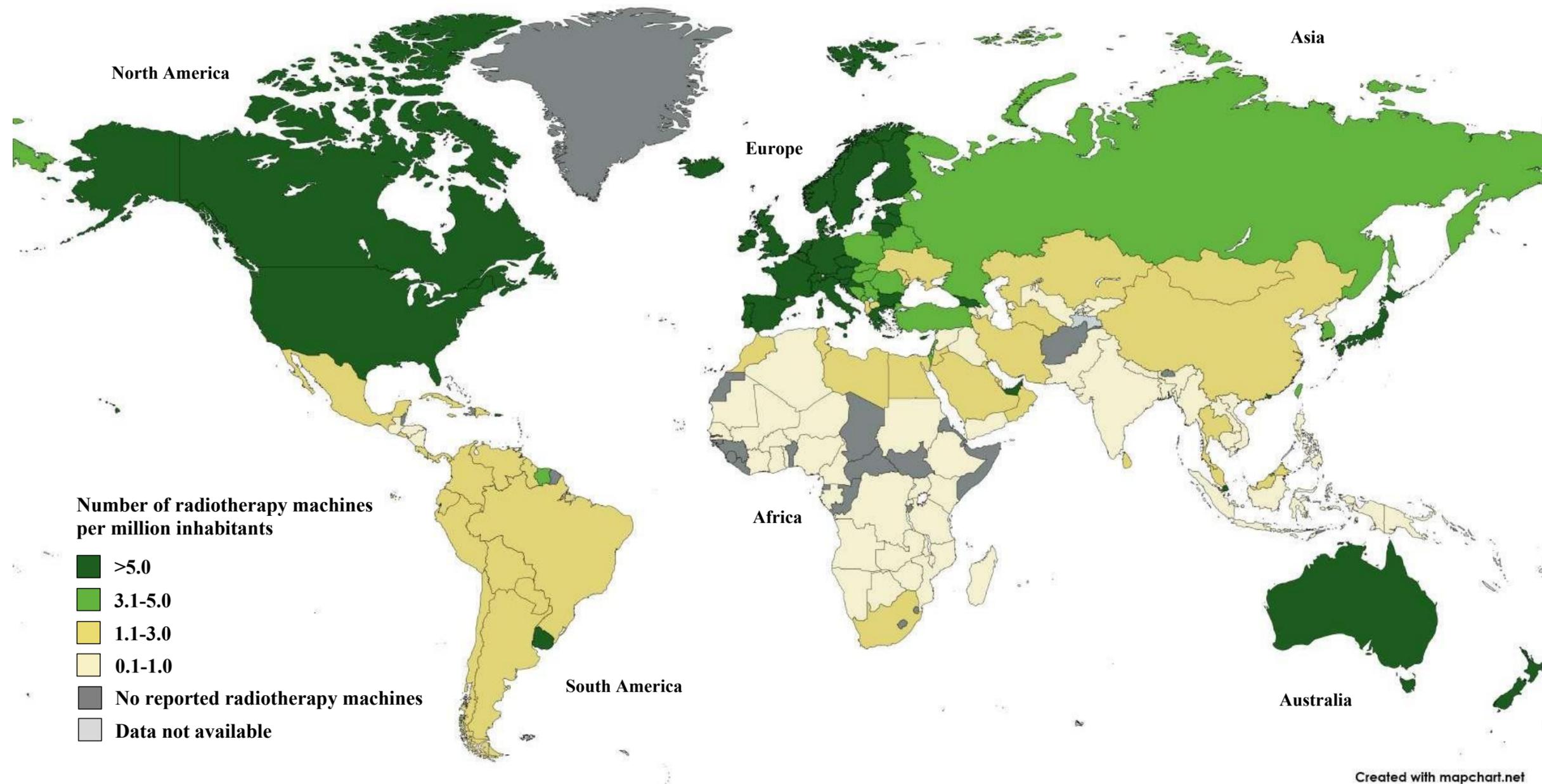
ESTRO Study: Access to RT technology in the European region (2013)



Challenges not only in LMICs

ESTRO – HERO Study (Health Economics and Radiation Oncology): Eastern and South-Eastern European countries need to expand and modernise their radiotherapy equipment.

Lancet Oncology Commission: RT access still showing huge disparities (2024)



CT Scanners Distribution per Million Population

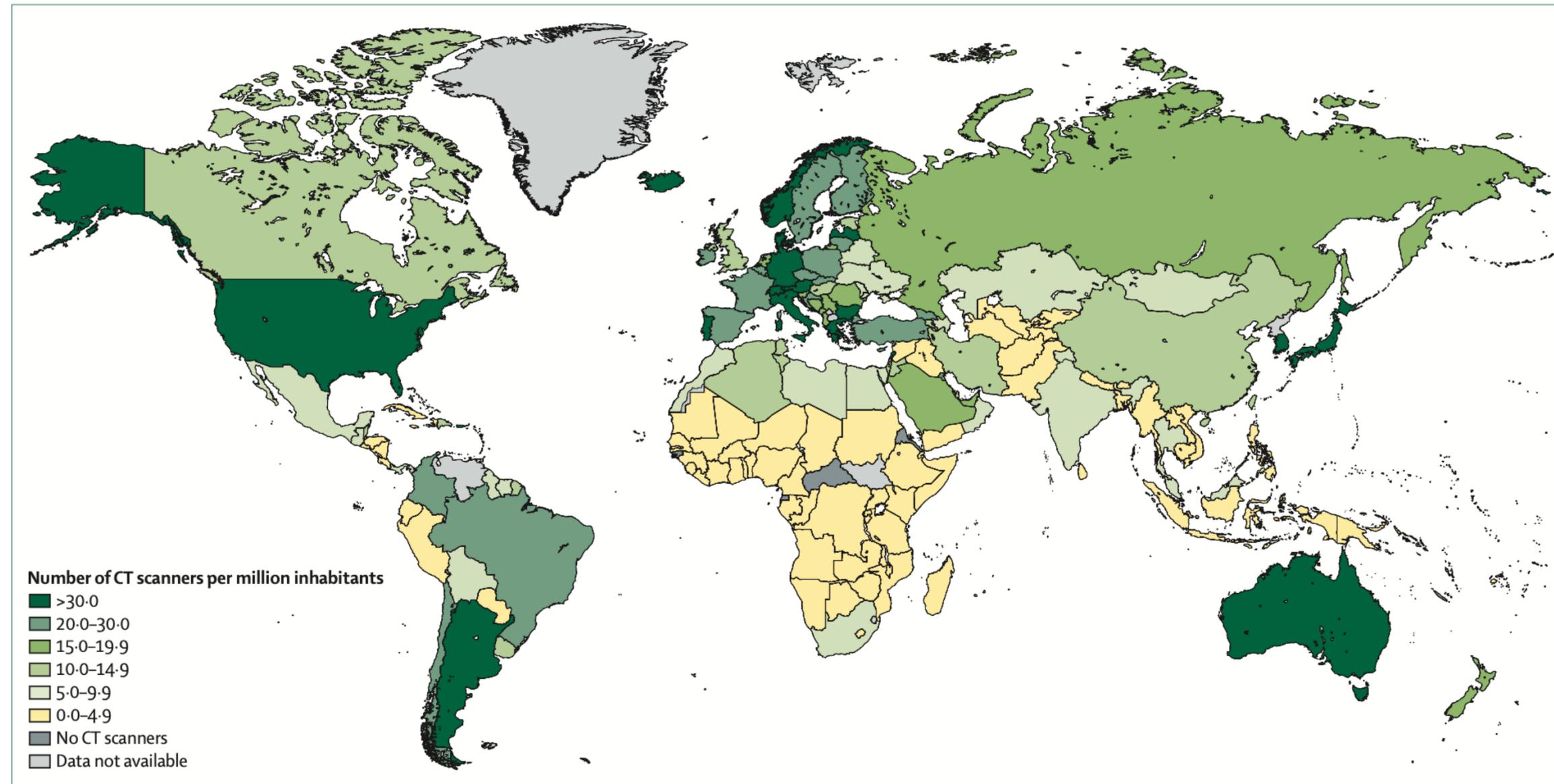


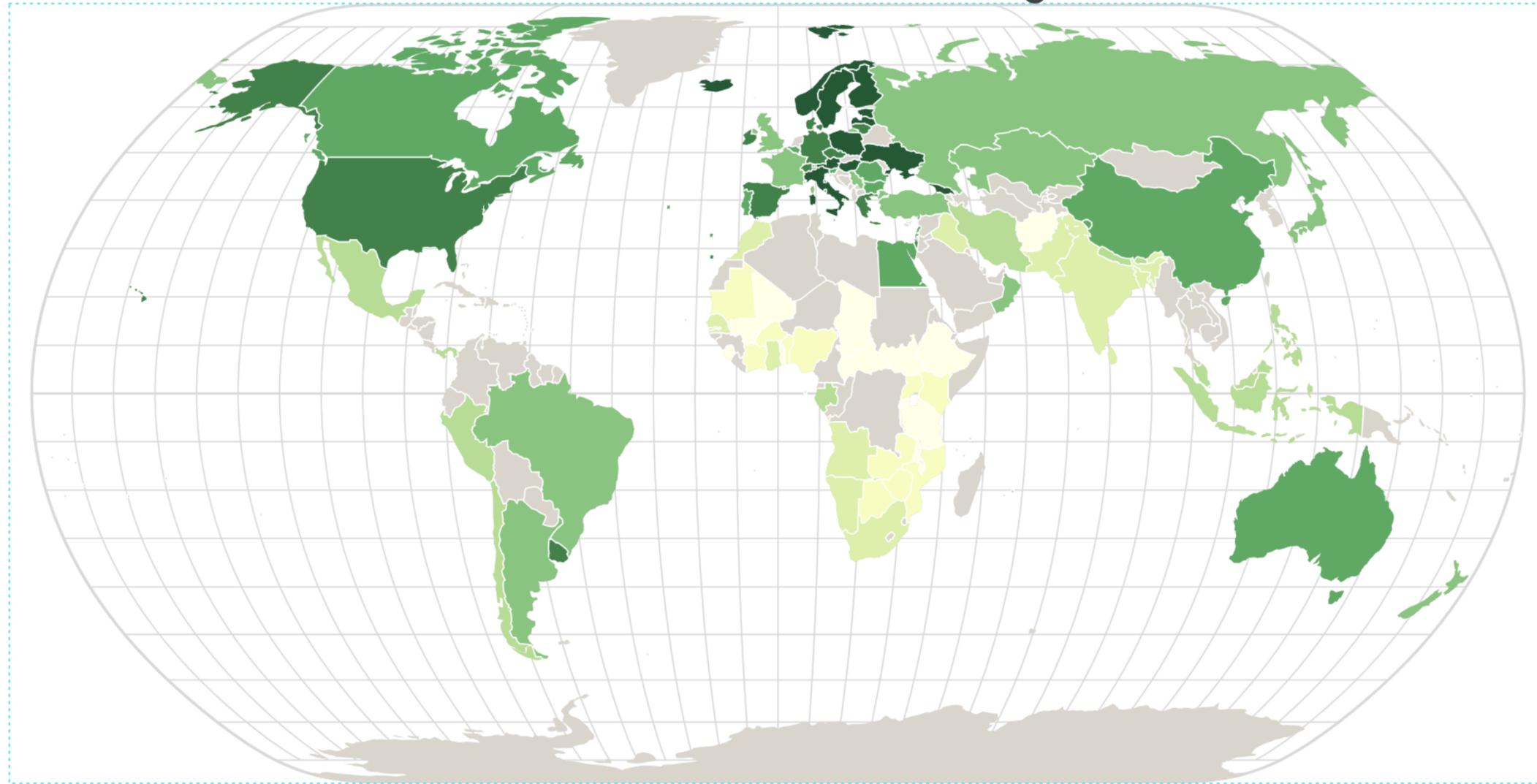
Figure 2: Estimates of the number of CT scanners per million inhabitants

Data are from the International Atomic Energy Agency medical imaging and nuclear medicine global resources database (IMAGINE). The map was produced by the International Atomic Energy Agency (Vienna, Austria) and is included here with permission.

CT scanners are an essential diagnostic tool in cancer care. However, high-income regions like North America and Europe have significantly higher access to CT scanners compared to LMICs.

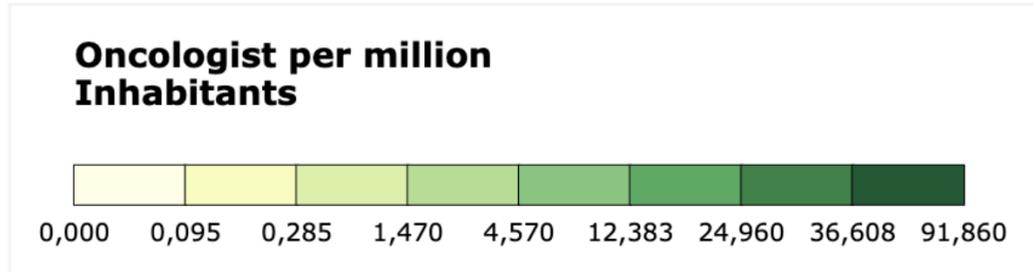
Disparities in Access to Oncologists

Global Distribution of Oncologists

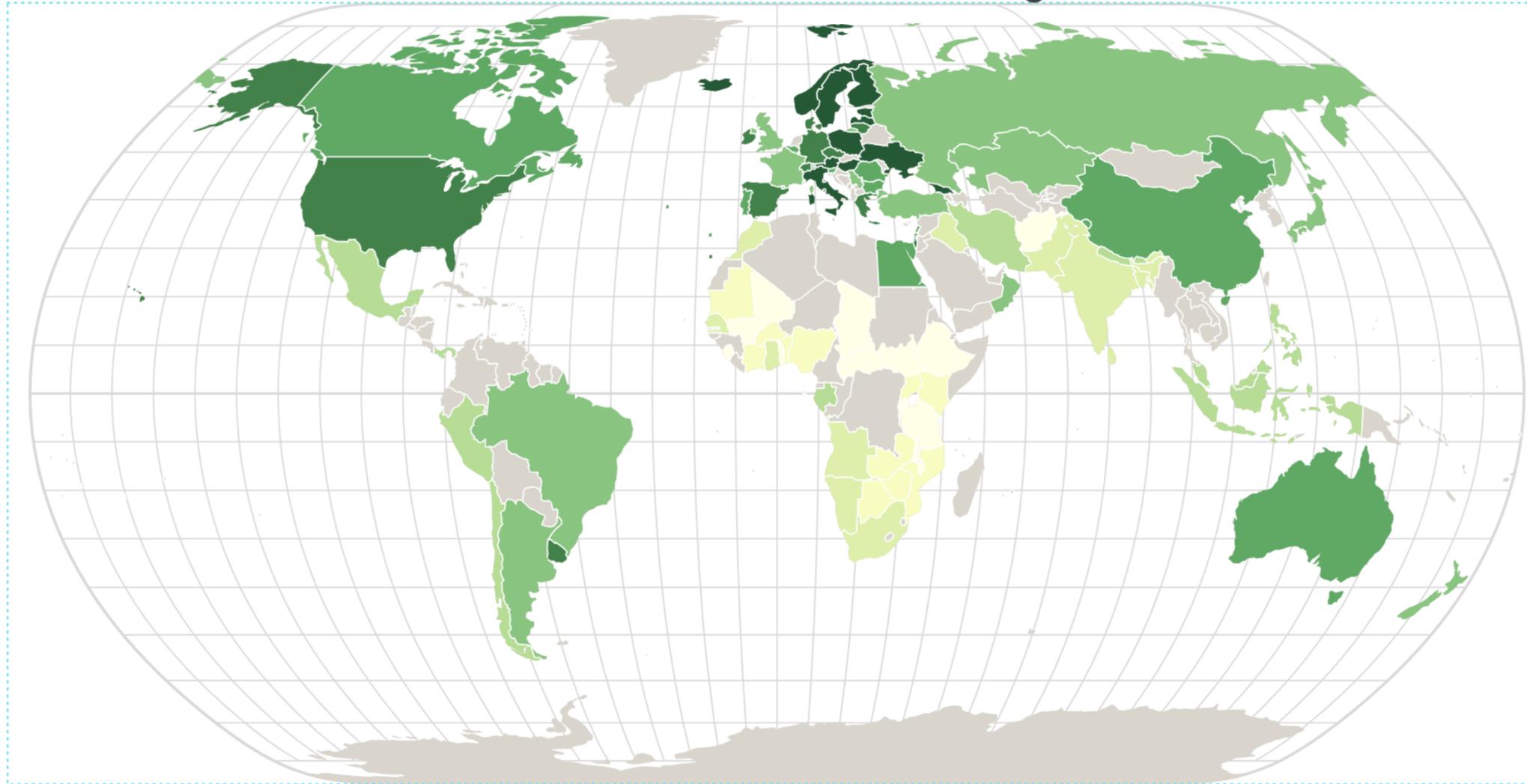


basemap from Natural Earth (CC0) - Global Survey of Clinical Oncology Workforce, Author: Aju Mathew, Publication: Journal of Global Oncology, 2/8/2018

ICEC, 2024, CVM



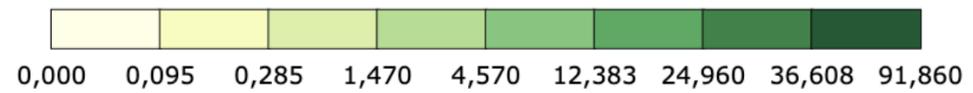
Global Distribution of Oncologists



basemap from Natural Earth (CC0) - Global Survey of Clinical Oncology Workforce, Author: Aju Mathew, Publication: Journal of Global Oncology, 2/8/2018

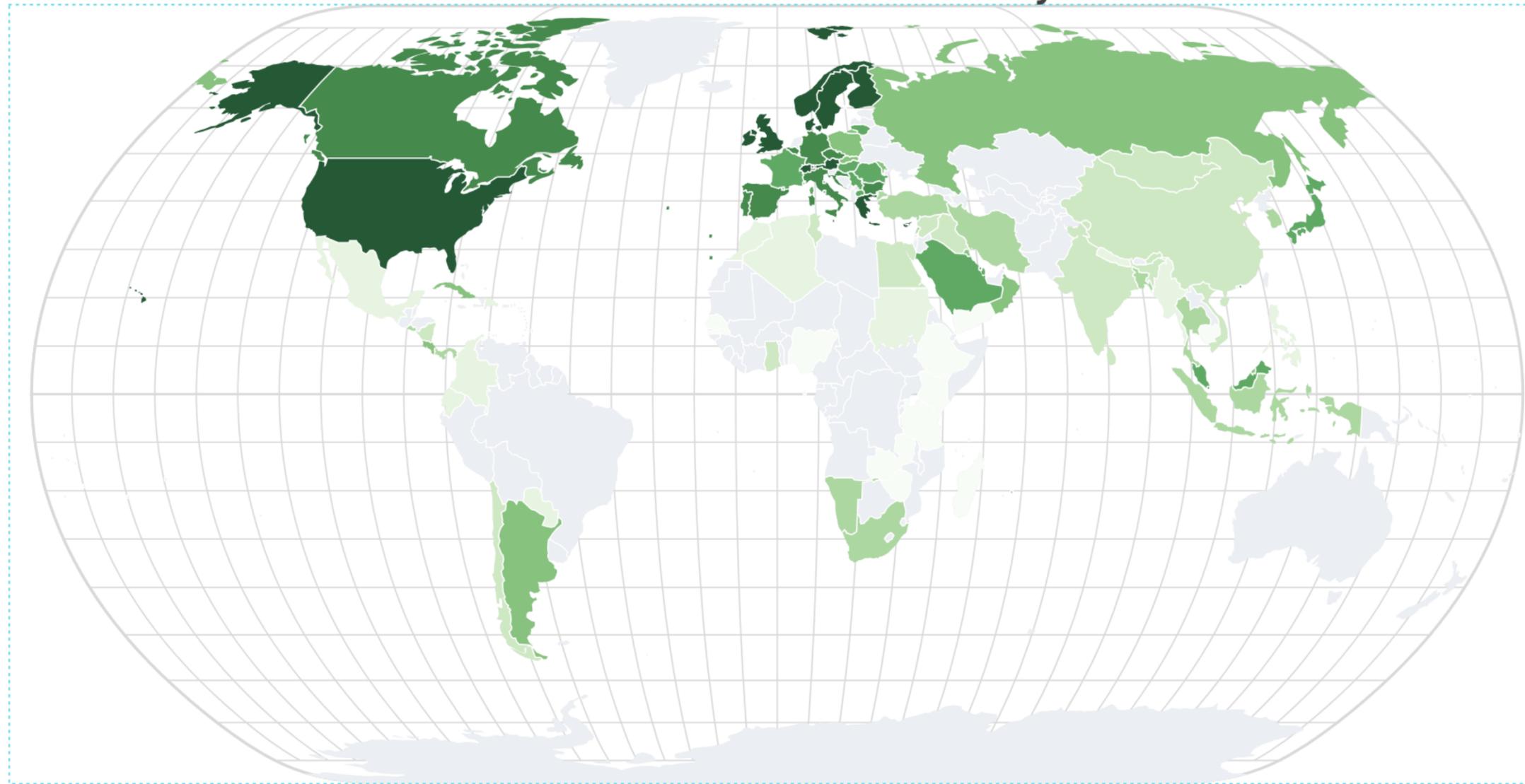
ICEC, 2024, CVM

Oncologist per million Inhabitants



Availability of Medical Physicists Worldwide

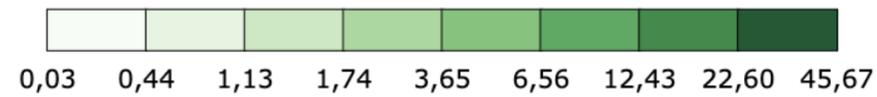
Global Distribution of Medical Physicists



ICEC, 2024, CVM

basemap from Natural Earth (CC0) - Medical physics workforce: A global perspective, Virginia Tsapaki, Physica Medica, Volume 55, November 2018, Pages 33-39

MP per Million Inhabitants



Project **STELLA** (**S**mart **T**echnologies to **E**xtend **L**ives with **L**inear **A**ccelerators)

STELLA is a global collaboration for improving access to RT for all

- Expanding access to high-quality cancer treatment globally
- Developing innovative and transformative radiation therapy treatment system
- Driving down the cost of RT and cancer care
- An enhanced training, education and mentoring program that catalyzes RTT implementation in the global context



International
Cancer
Expert Corps



Science and
Technology
Facilities Council



UNIVERSITY OF
OXFORD



UNIVERSITY OF
CAMBRIDGE



There are dramatic disparities in Access in LMICs

Africa: 400 RT units for around **1.4 billion** people

1 machine per 3.5 million people

US: 4000 RT units for around **340 million** people

1 machine for 86,000

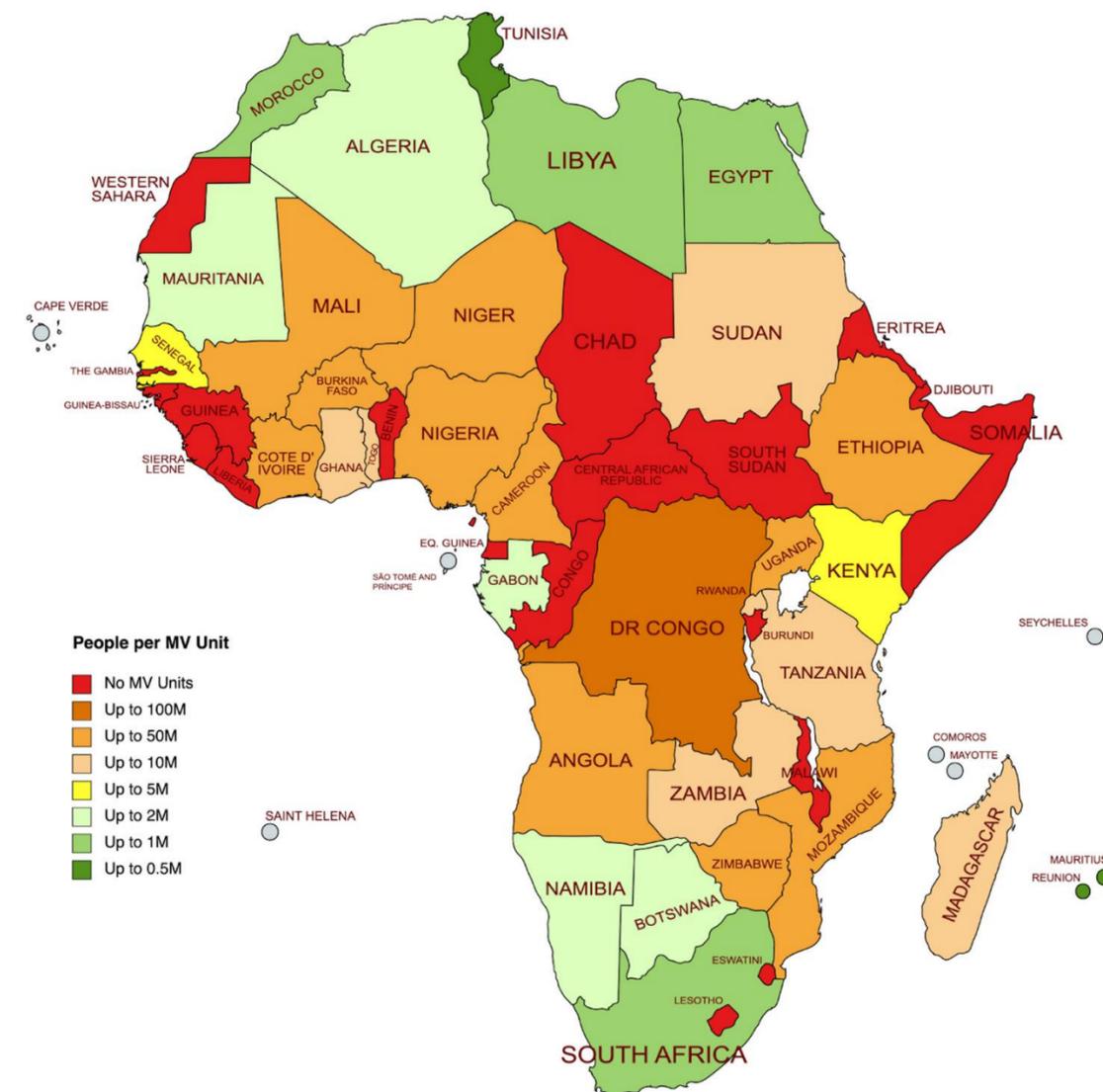
UK: 360 RT units for around **68 million** people

1 machine per 190,000

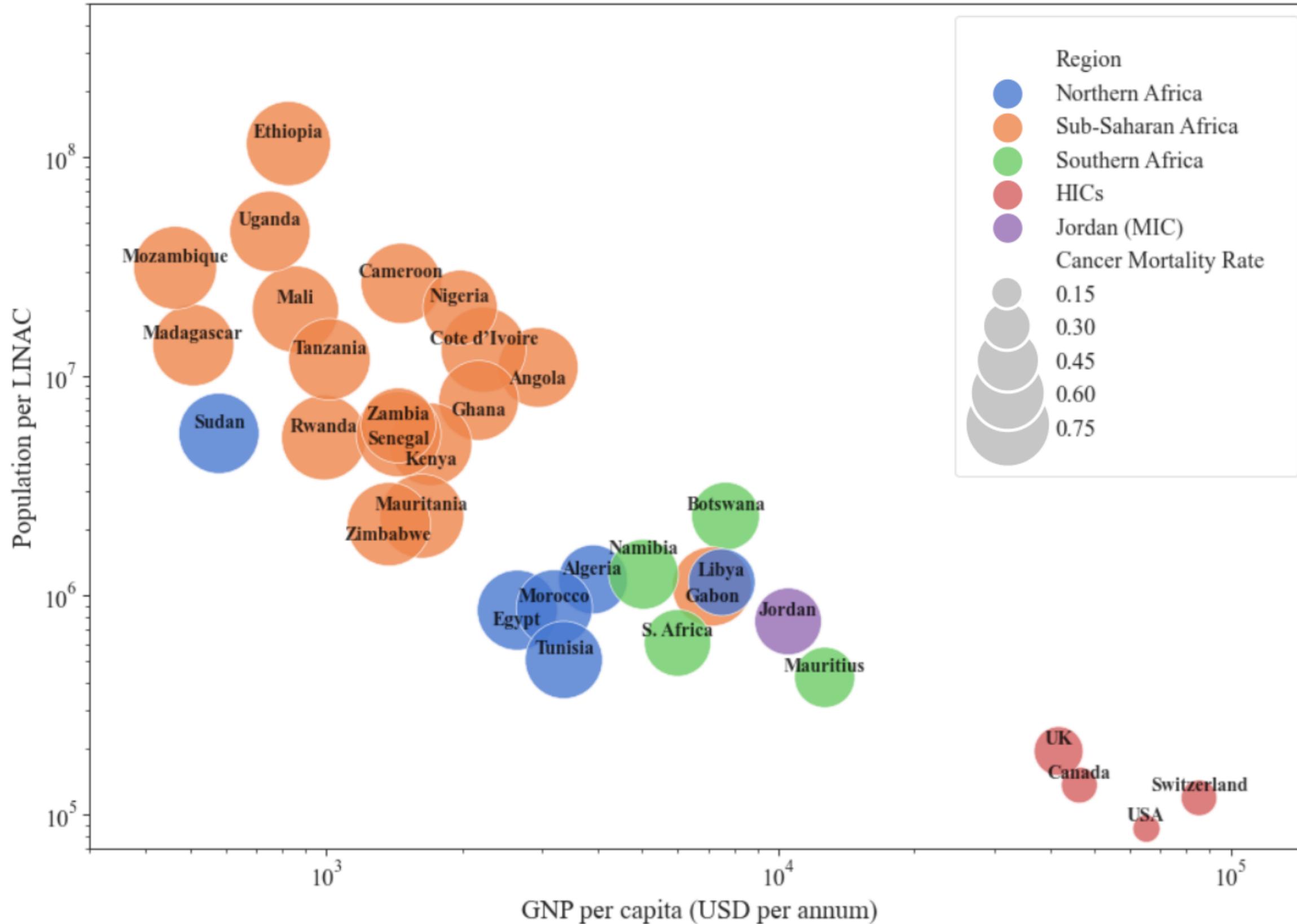
Switzerland: 85 for **8.8 million** people

1 machine for 100,000

- By 2030, there will be **1.4 million** new cases of cancer and there will be **1 million** cancer deaths in Africa
- In 2019 only **28** countries had RT facilities
- Over **60%** are in **just 3 countries**: South Africa, Egypt and Morocco
- 20 countries have none

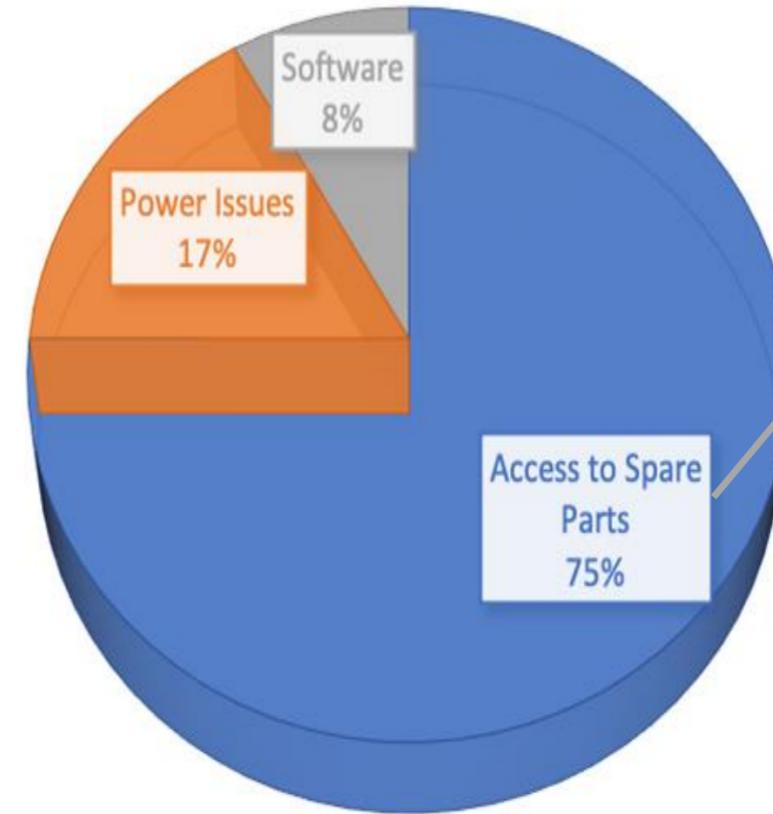
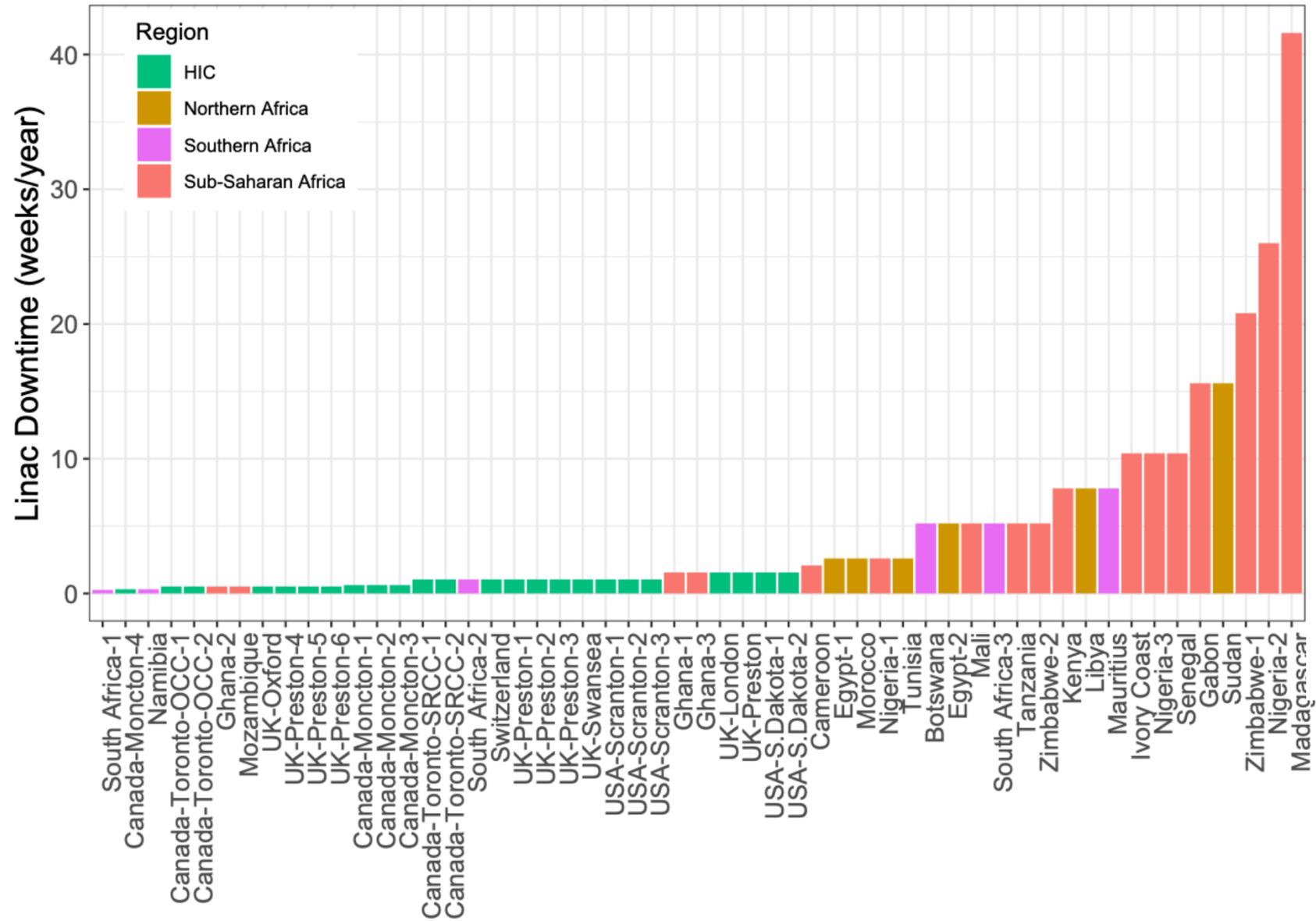


GNP and Ratio of Inhabitants to Linacs and Cancer Mortality



Ige et al, *Surveying the Challenges to Improve Linear Accelerator-based Radiation Therapy in Africa: A Unique Collaborative Platform of All 28 African Countries Offering Such Treatment*. Clin Onco, 2021 33e521-e529 <https://doi.org/10.1016/j.clon.2021.05.008>

LINAC Downtime by Country (weeks/year)



- **69%** don't have access to spare **RF Sources**.
- **65%** don't have access to spare **Vacuum Pumps**.
- **63%** don't have access to spare **Electron Guns**.
- **32%** don't have access to spare **MLCs**.

Outcomes from our three country studies

- Raising awareness, education, prevention,
- Screening, diagnosis, treatment
- Need innovation and research resulting in more affordable and accessible treatment
- Need multifaceted capacity building for sustainable workforce



The requirements for a STELLA radiotherapy system

- Modular design for simplified maintenance
- Novel accelerating structure (patent filed)
- Modular and low current electron gun
- Longer-lifetime parts
- Mechanically simplified high-performance MLC
- Predictive maintenance capabilities
- Simplified vacuum procedures
- Multi-modal image guidance
- Surface tracking integration

Using smart design and AI, we will



Lower purchase cost and staff requirements



Maximise uptime and access to RT

SAPPHIRE (Supra-African Physics Partnership for Health and Radiotherapy Expansion)

- Strengthening the medical physics workforce through training and mentoring
- Collecting and analysing real-world data from the LINAC machines in Ghana and Pretoria
- Improving the design of critical hardware components such as the multi-leaf collimator (MLC)
- To compare the performance of candidate designs with current-generation commercial LINAC devices for treatment planning using clinical data.
- Developing robust, smart LINAC systems suited for low- and middle-income settings



<https://project-sapphire.org>



Collaborators & Team

Partners

UK-Based Institutions



University of Oxford



UNIVERSITY OF CAMBRIDGE

University of Cambridge



Lancaster University

Lancaster University



Science and Technology Facilities Council

Science and Technology Facilities Council (STFC)

Africa-Based Institutions



Ghana Atomic Energy Commission



Korle-Bu Teaching Hospital



Komfo Anokye Teaching Hospital



Kwame Nkrumah University of Science and Technology

International Partners



CERN – European Organization for Nuclear Research



International Cancer Expert Corps (ICEC)



Prof. Graeme Burt
Lancaster University, UK
Group leader of the RF Engineering of Accelerators



Prof. Manjit Dosanjh
University of Oxford, UK
Visiting Professor/former Senior Advisor for Medical Applications at CERN



Prof. Raj Jena



Steve Biko Academic Hospital



UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

University of Pretoria



Prof. Eric Desmond Clement
Kotei Addison
Komfo Anokye Teaching Hospital, GHANA
Head of Medical Physics



Dr. Hannah Naa Gogwe
Ayettey Anie
Korle Bu Teaching Hospital, GHANA
Consultant Radiation/Clinical Oncologist



Mr Thulani Mabhengu
Steve Biko Academic Hospital, Pretoria, South Africa
Research co-leader, Deputy Director Medical Physics



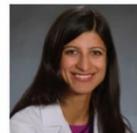
Ms Mpho Madima
Steve Biko Academic Hospital, Pretoria, South Africa
Research and innovation associate, Medical Physics Intern



Mr Mohau Mashaba
Steve Biko Academic Hospital, Pretoria, South Africa
Research co-leader, Director Medical Physics



Ms Tshogofatso Maswabela
Steve Biko Academic Hospital, Pretoria, South Africa
Research and innovation associate, Medical Physics Intern



Prof. Surbhi Grover
University of Pennsylvania / Steve Biko Academic Hospital, USA / South Africa
Project Co-lead (International)



Prof. Francis Hasford
Ghana Atomic Energy Commission (GAEC)
Deputy Director-General, FAMPO President



Mr Lutendo Netshwadi
Steve Biko Academic Hospital, Pretoria, South



Ms Jane Nubi
Steve Biko Academic Hospital, Pretoria, South



Ms Lebohane Ratshebaya
Steve Biko Academic Hospital, Pretoria, South Africa
Professional enabling staff, Medical Physics



Mr Nicolas Rovetto
Steve Biko Academic Hospital, Pretoria, South Africa
Research and innovation associate, Medical Physics Intern



Prof. Steinar Stapnes
CERN, Geneva, Switzerland
European Representative on the Executive Board of the International Linear Collider (ILC) Development Team



Mrs Donna O'Brien
Strategic Visions in Healthcare, LLC and ICEC
ICEC Board member



Dr Laurence Wroe
CERN, Geneva, Switzerland
Accelerator Physicist



Mrs Nina Wendling
International Cancer Expert Corps (ICEC), USA
ICEC Executive Director/Project STELLA Training lead

SAPPHIRE-Ghana visit by **STFC** (Michele Dougherty) **IOP** (Tom Grinyer) and **APS** (Jon Bagger)



12th February 2026