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COVER NOTE

Subject:	The European research roadmap for medical applications of ionising radiation - Powerpoint presentation (Research (Atomic Questions) WP meeting 12.06.2024)

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The European research roadmap for medical applications of ionising radiation

Christoph Hoeschen
On behalf of the EURAMED rocc-n-roll project consortium

Working Party on Research (Atomic Questions) 12th of June

This project has received funding from the Euratom research and training programme 2019-2020 under grant agreement No 899995

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Disclosures

- Christoph Hoeschen was the Scientific coordinator of the EURAMED rocc-n-roll project.
- This project has received funding from the Euratom research and training programme 2019-2020 under grant agreement No 899995.

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Perspective of the Research Roadmap for Medical Applications of Ionising Radiation

- Roadmap developed from the perspective of Patient's benefit-risk balance
- Identifying the needs in subsequent stages of life
- Challenges identified in developed SRA on ionising radiation and related radiation protection are the basis of the Roadmap
- Fits well into SAMIRA agenda
- And makes use of and complements other initiatives (EUROFUSION, EURAD, PIANOFORTE, ENEN, EUCAIM)

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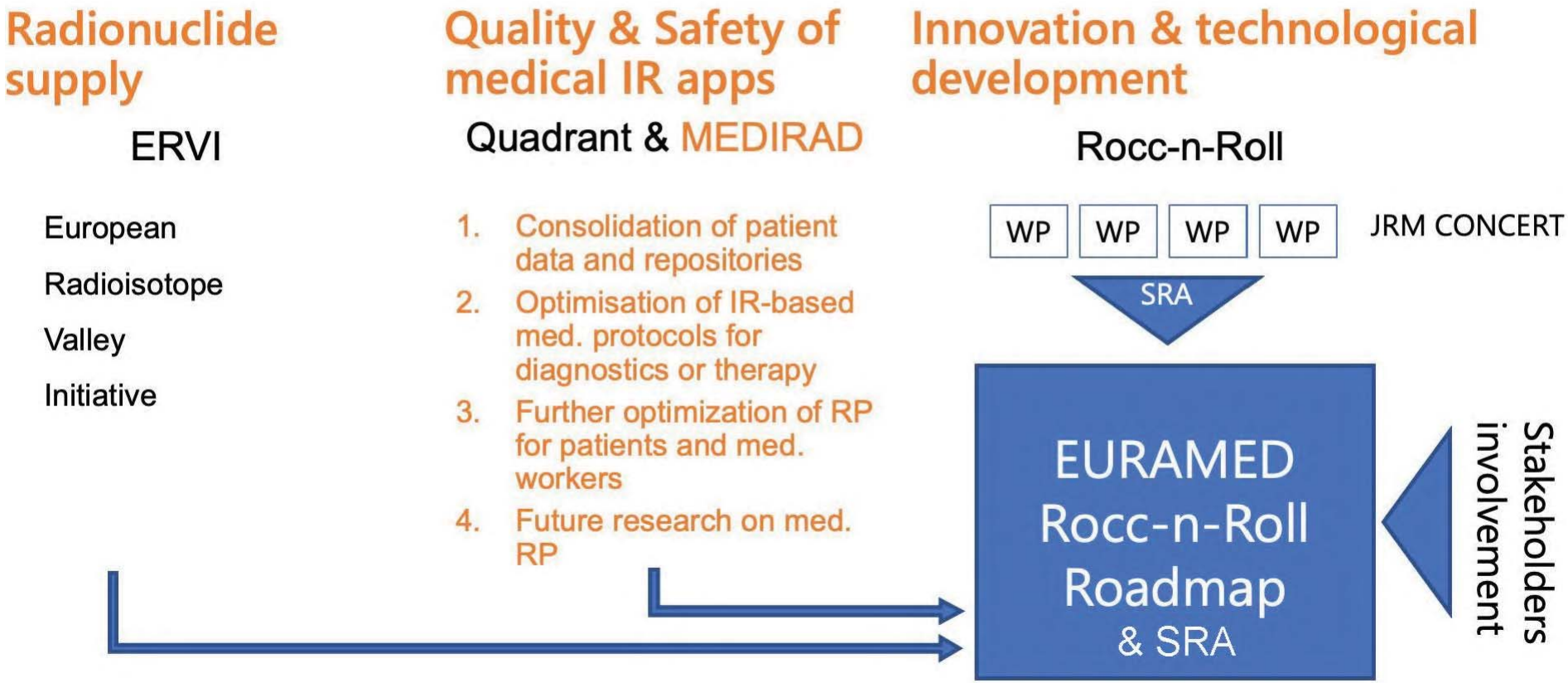
SAMIRA Strategic Agenda for Medical IR applications:
Situation of the RnR roadmap as proposed methodology



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Project Data

- **Name:** EURopeAn MEDical application and Radiation prOteCtion Concept: strategic research agenda aNd ROadmap interLinking to heaLth and digitisation aspects
- **Acronym:** EURAMED rocc-n-roll
- **Call/Topic:** Research roadmap for medical applications of ionising radiation
- **Type of action:** Coordination and support action
- **Duration:** 36 months
- **Start date:** September 1, 2020
- **End date:** August 31, 2023
- **Grant Amount:** 1,959,175.00

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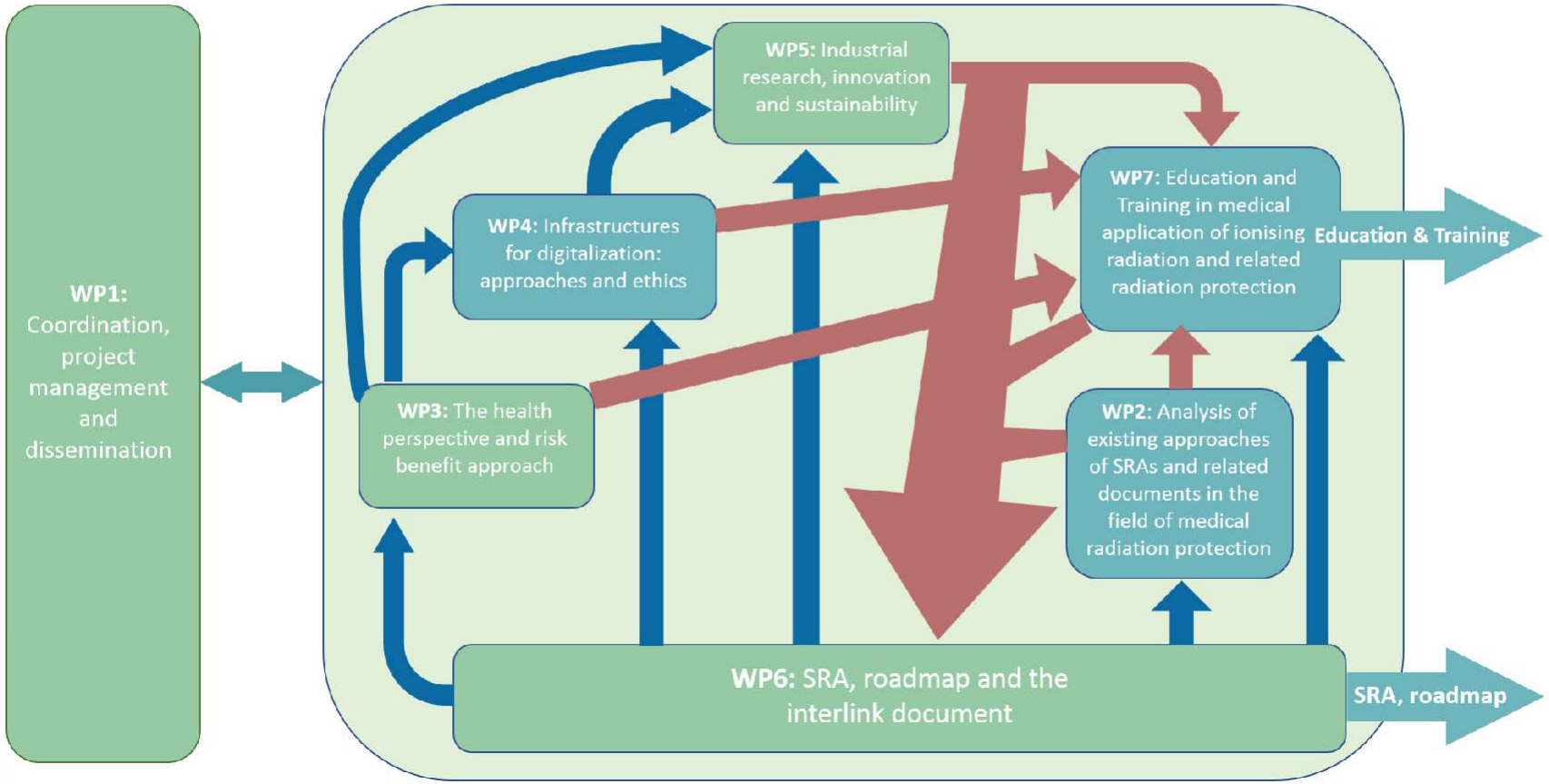
Work Packages



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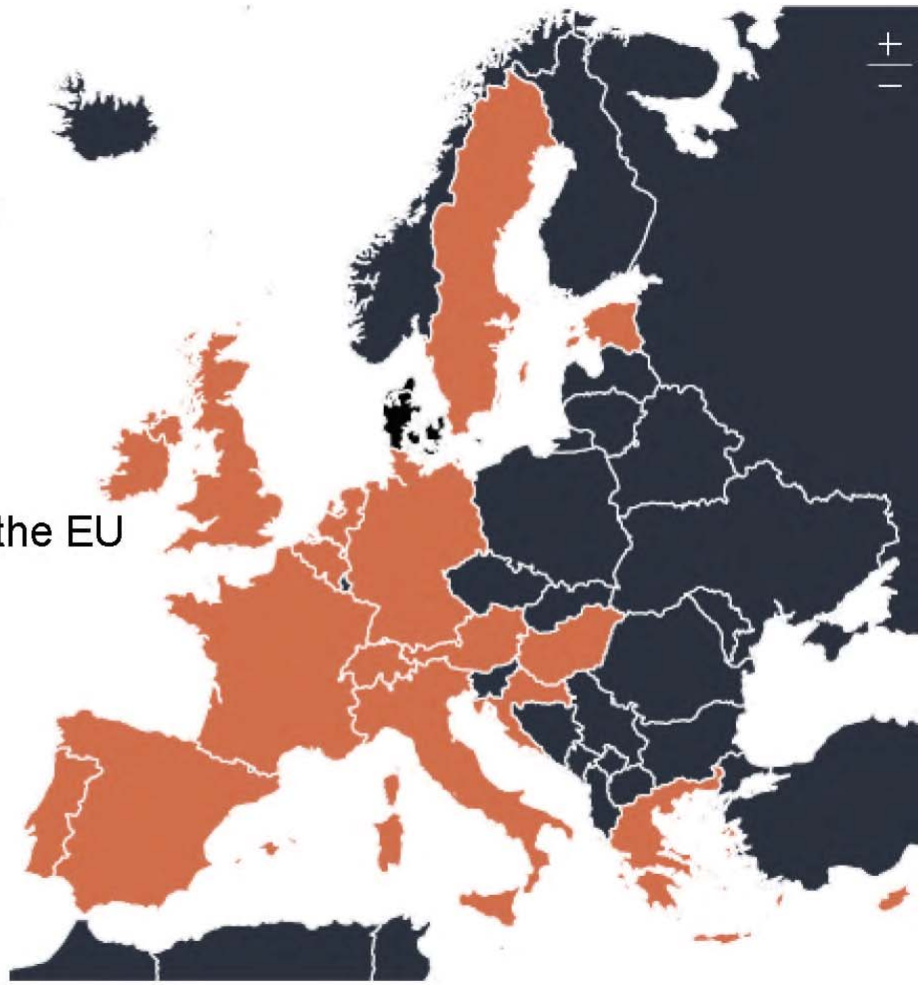
Working principle

- 29 partners
- Have set up tasks and task members
- Advisory board for support (from many of the EU countries not represented as partners)
- Additional external experts named based on workshop and panel concept



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Outputs

Strategic research agenda (SRA)

Defining the needs, gaps and opportunities for research in medical application of ionizing radiation and radiation protection.

** based on the existing EURAMED SRA*

Roadmap

Highlighing game changers;

Transferability into sustainable production and clinical practice;

Predicting timelines and budgets;

Ultimately improving patient care.

Interlink document

Showing the potential interactions and relations between the different components of the SRA;

Representing the interlinks to nearby fields.

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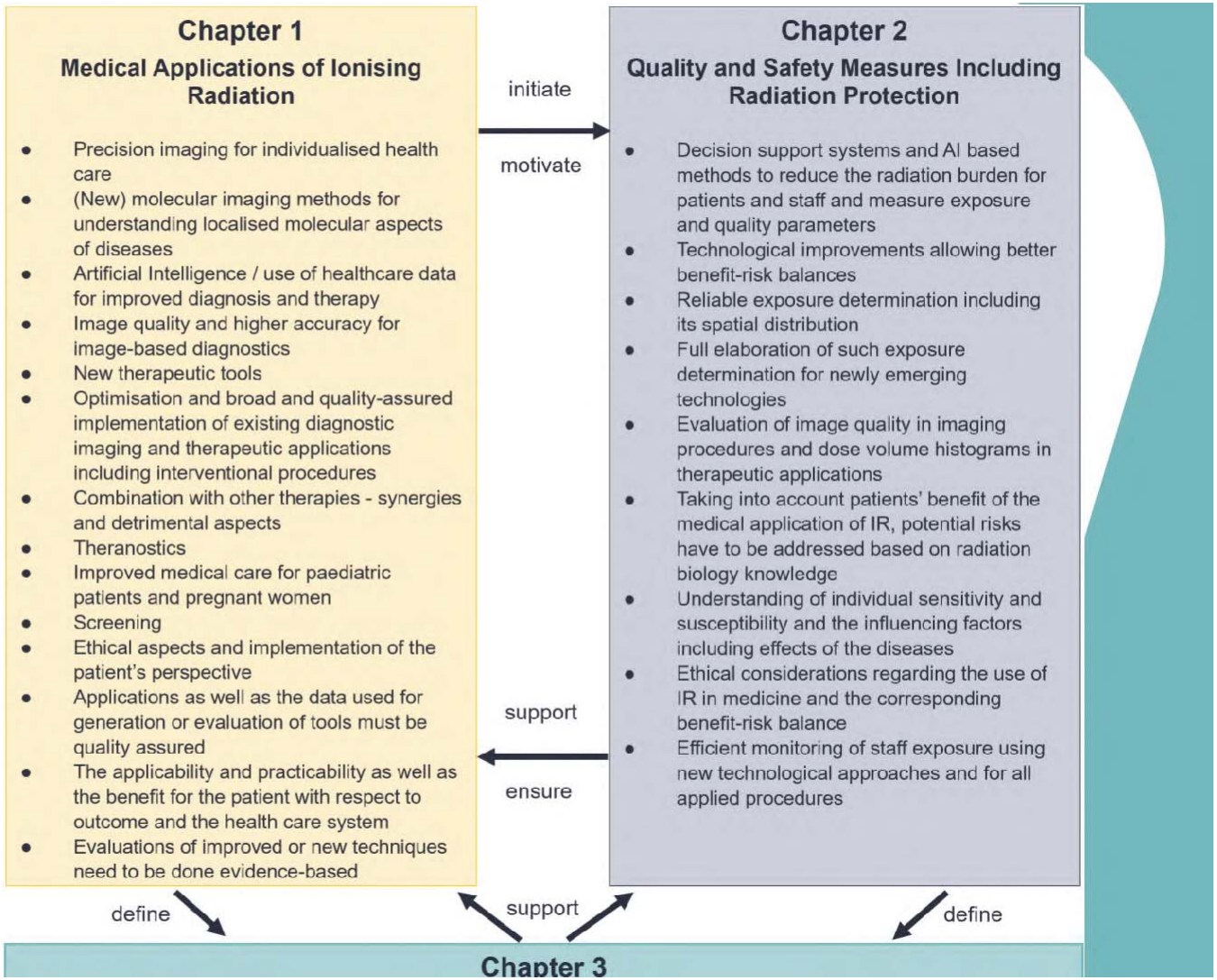
SRA



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SRA

- The applicability and practicability as well as the benefit for the patient with respect to outcome and the health care system
- Evaluations of improved or new techniques need to be done evidence-based

ensure

new technological approaches and for all applied procedures

define

support

define

Chapter 3
Organisational Requirements

- Fit-for-purpose support structures for the research and innovation system
- Technology transfer
- All relevant digitalisation aspects
- Education and Training (E&T) for existing and future medical staff

Specifically:

- Potential Centres of Excellence (CoEs) on medical applications of IR and medical RP research
- Sustainability of resources for new and existing applications
- Ensuring clinical implementation of innovation including corresponding financial aspects across countries in Europe
- Digitalisation in the field of medical applications of IR for personalised medicine and electronic health records, RP, standardisation of data formats and Artificial intelligence (AI)
- Digitalisation in the field of medical applications of IR is related to a number of ethical issues and accompanying research needs like diversity, inclusion, and equity concerns related to personalised medicine
- Effective clinical decision making in the context of (potentially) biased datasets
- Implementing and updating the education and training in medical applications of IR and related quality and safety aspects
- Transfer and translation in the field of medical applications of IR is an ongoing challenge for a useful innovation chain

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European Research Roadmap For Medical Applications of Ionising Radiation for Better and Individualised Healthcare to Improve Patients' Lives

Vision

- **improve patient care in Europe** especially for **cancer patients**, patients suffering from **cardiovascular diseases** and **neurovascular diseases.**
- **provide guidance** to European policymakers, funders, and the scientific and clinical communities regarding research priorities, infrastructure development, and education and training actions.
- proposed **actions are prioritised regarding their impact on patients' life** expectancy and/or quality of life,
- radiation protection should be recognised as an integral part of **quality and safety measures**.
- to drive **progress in personalised medicine** using medical applications of IR in Europe.
- this **requires crucially** the strong **implementation of clinics** into the research activities.

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Roadmap organised using concept of breakthroughs

The roadmap defines **breakthroughs** as
"*Research and technological developments that may substantially impact medical applications of ionising radiation from the perspective of patients' life expectancy and/or life quality, radiation protection and health care systems*".

Directly patient related breakthroughs

Generic breakthroughs

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Patient-related R&D Breakthroughs 1 - 4

1. Improve / develop diagnosis

- Decision-making
- Technical developments including AI-based methods
- Screening
- Molecular imaging methods
- Quantitative imaging and radiomics

2. Improve / develop therapy

- Radiation oncology
- Theranostics
- Interventional procedures

3. Patient radiation protection and benefit-risk ratio

- Radiation biology
- Patient dosimetry

4. Patient relations

- Individual benefit-risk balance assessment
- Involvement of patients in research
- Shifting the communication landscape
- Ethical data management

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Generic Breakthroughs 5 - 8

5. Strategic positioning of applications of IR in medicine

- Comparison of benefit-risk with other medicine
- Synergies with non-IR techniques
- Economical aspects and funding of R&D

6. Implementation, sustainability, and organisation of IR-based medicine

- Translation & organisation
- Research for sustainable supply including radionuclides
- Access to data, biobanks and equipment
- Harmonisation of data and protocols

7. Quality, safety, and legislation in Europe

- Quality determination
- Q&S for diagnosis and therapy
- Clinical quality and safety audits
- Improve the safety culture
- Harmonisation of EU legislation

8. Career attractivity and radiation protection for workers

- Career attractiveness
- Radiation protection for workers

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Patient related breakthroughs require highest budget

Implementation of improved diagnosis or therapy requires

A: Basic research on clinical questions and biology (0.5 to 10 million euro)

B: Basic research on new technological approaches (1 to 50 million euro might apply, e.g., to new hadrontherapy sources)

C: Research on possibilities for patient-centred implementation (1 to 5 million euro)

D: Research on ethical implications (0.5 to 3 million euro)

E: Technological transfer (0.5 to 20 million euro)

F: Clinical studies to prove evidence for the advantages of the proposed new or optimised methods (2 to 10 million euro)

Smaller amounts needed for other BTs

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Impact of breakthroughs

IMPACT criteria:

- **number of European patients potentially benefitting from the innovation**
- **improvement of life quality of patients, including patient comfort and patient safety, including RP**
- **increased life expectancy**
- **improved healthcare from a societal perspective, including financial and organisational improvements**

A reasonable progression of all BTs in a balanced way is desirable

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Impact of breakthroughs - example:

IMPACT example: *Decision making in diagnostic procedures*

- **number of European patients potentially benefiting from the innovation – very high**
- **improvement of life quality of patients, including patient comfort and patient safety, including RP - high**
- **increased life expectancy - high**
- **improved healthcare from a societal perspective, including financial and organisational improvements – very high**

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Conclusions I

- European patients especially those suffering from cancer, cardiovascular, neurovascular, infectious and inflammatory diseases as well as other diseases including rare diseases can benefit very strongly from new or optimised medical applications of ionising radiation.

- There are new technologies like artificial intelligence, new radiation sources, nanomaterials, new detector concepts and new insights into biological questions that can allow great advances in European patient care.

- Application of IR in medicine can by nature be and foster personalised medicine, actually it is in many cases the cheapest and easiest approach to personalized medicine.

- Medical application of IR will allow improved healthcare also from a societal perspective, including financial and organisational improvements.

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Conclusions II

- The great chance inherent in the best use of medical applications of IR in Europe needs sufficient research efforts and corresponding funding.

- It is absolutely mandatory to have the clinical research institutions with close links to clinics and patient care drive the research and be strongly involved in it. This includes all fields of medical applications of IR: radiology, interventional radiology, radiation therapy and nuclear medicine, all of them always supported by medical physics, radiographers/technicians and biologists etc.

- Quality and safety including radiation protection is a central necessary component of meaningful and benefical use of IR in medicine. The EURATOM program is already supporting the related research as well as corresponding education and training and need to go on with that support as well as support for radiation biology and waste management research.

- To tap the full potential of the new or optimized applications of IR in medicine a common approach between Horizon Europe, especially cluster 1 potentially with a focus at the moment on the mission on cancer, but not limited to that mission, and also other clusters.

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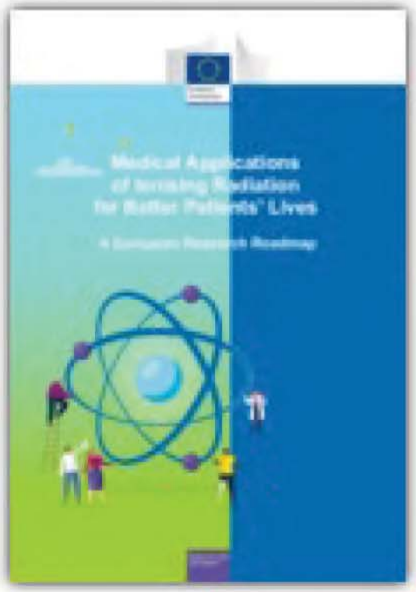

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ANNEXE

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IMPACT criteria:

- number of European patients potentially benefiting from the innovation
- improvement of life quality of patients, including patient comfort and patient safety, including RP
- increased life expectancy
- improved healthcare from a societal perspective, including financial and organisational improvements

A reasonable progression of all BTs in a balanced way is desirable

	Number of patients benefiting from innovation	Improvement of life quality (comfort and radiation protection)	Increased life expectancy	Improved healthcare system (societal perspective and organisational improvements)
PATIENT-RELATED BREAKTHROUGHS				
BT 1 IMPROVE/DEVELOP DIAGNOSIS	very high	high	high	high
Decision-making	very high	high	high	very high
Technical developments including AI-based methods	very high	high	unclear	high
Screening	very high	unclear	high	very high
Molecular imaging methods	high	very high	high	high
Quantitative imaging and radiomics	high	very high	high	high
BT 2 IMPROVE/DEVELOP THERAPY	high	very high	very high	high
Radiation oncology	high	very high	high	high
Theranostics	medium	high	high	high
Interventional procedures	high	very high	very high	very high
BT 3 PATIENT RADIATION PROTECTION AND BENEFIT-RISK RATIO	very high	high	medium	medium
Radiation biology	very high	high	medium	medium
Patient dosimetry	very high	medium-high	medium-low	medium
BT 4 PATIENT RELATIONS	very high	high	medium-low	medium
Individual benefit-risk balance assessment	very high	very high	medium-low	medium
Involvement of patients in research	medium-low	medium-high	medium	high
Shifting the communication landscape	very high	high	medium-low	medium
Ethical data management	very high	high	unclear	high
GENERIC BREAKTHROUGHS				
BT 5 STRATEGIC POSITIONING	medium-high	potentially high	potentially high	very high
Comparison of benefit-risk with other medicine	high	high	high	very high
Synergies with non-IR techniques	medium	potentially high	potentially high	high
Economical aspects and funding of R&D	medium	high	high	very high
BT 6 IMPLEMENTATION AND SUSTAINABILITY	high	high	high	high
Translation & organisation	high	high	high	high
Research for sustainable supply including radionuclides	medium	medium-high	medium-high	medium
Access to data, biobanks and equipment	medium	medium-high	medium	high
Harmonisation of data and protocols	very high	medium-high	high	high
BT 7 QUALITY, SAFETY AND LEGISLATION IN EUROPE	high	high	medium-high	high
Quality determination	high	high	medium-low	high
Q&S for diagnosis and therapy	high	high	medium-high	high
Clinical quality and safety audits	high	high	high	medium-high
Improve the safety culture	medium-high	high	medium-low	medium
Harmonisation of EU legislation	high	high	medium-high	medium
BT 8 CAREER ATTRACTIVITY AND RADIATION PROTECTION FOR WORKERS	high	medium-high	medium	high
Career attractiveness	high	medium-high	medium	high
Radiation protection for workers	medium-low	medium	medium-low	medium-high

Table 1: Suggested evaluation of BTs' potential impact. The impact of research projects to be funded will have to be evaluated in more detail. The different impact-related indicators may serve as guides for funding research proposals, amongst other indicators. Eventually, a balanced scoring on the different impact indicators is suggested to evaluate a full research work programme, including all research projects. The category looking for the number of patients / citizens benefitting from improvements is defined really along the lines on how many persons will really see a change (not are affected at all).

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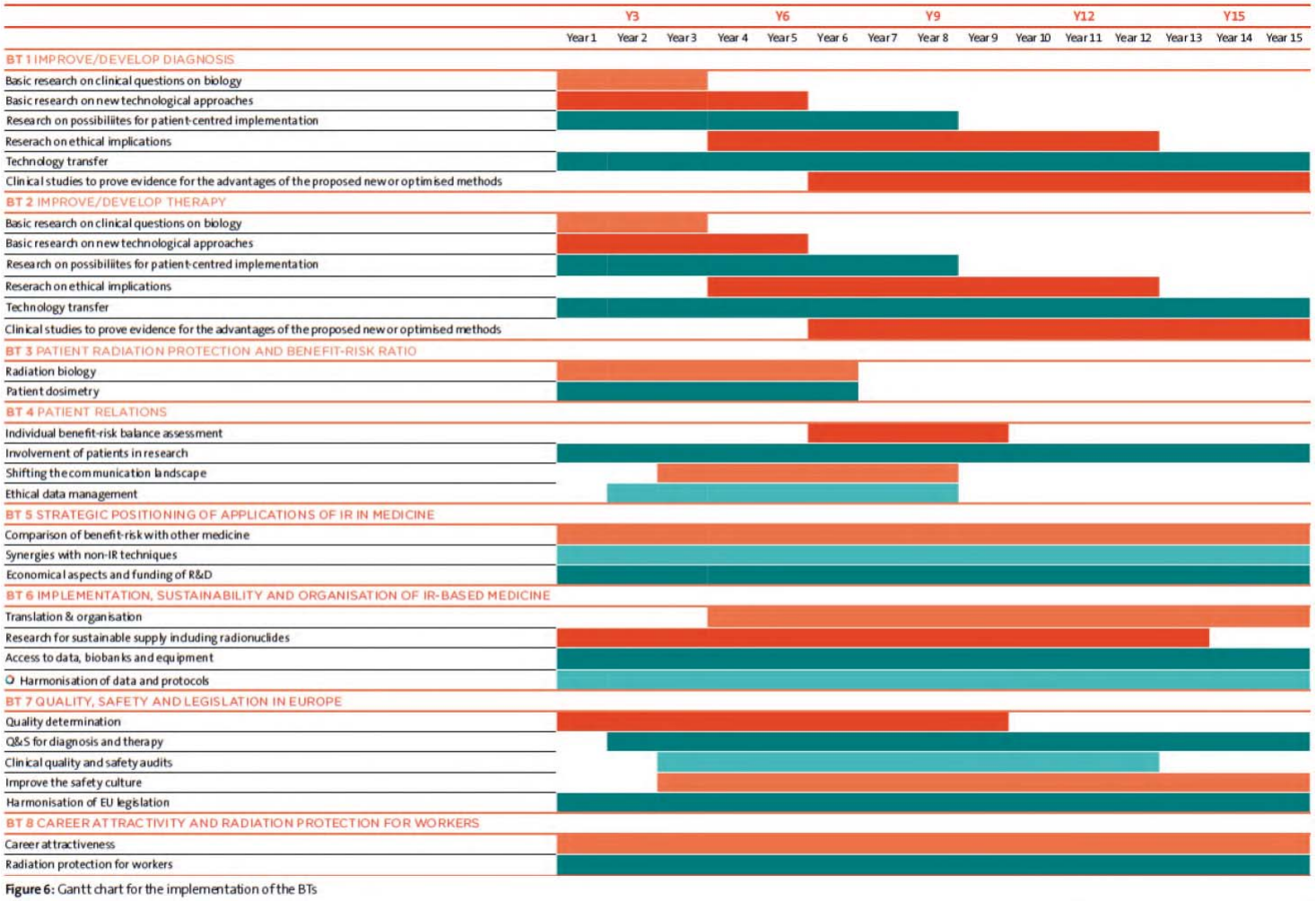

Figure 6: Gantt chart for the implementation of the BTs

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