Report

Nuclear Medicine: Is the outpatient model a solution for equitable access to internal vectorised radiotherapy?

November 20, 2024 – European Parliament

Nuclear medicine is currently undergoing significant advancements, particularly in the field of oncology, driven by the growing development of its therapeutic applications. This major evolution is paving the way for the introduction of internal vectorised radiotherapy (RIV), benefiting an increasing number of patients. However, nuclear medicine services across Europe face numerous challenges, including shortages of healthcare professionals, limited capacity, and uneven territorial coverage. As a result, these services often lack the necessary human and material resources to effectively address these issues. In this context, France has developed a model that enables outpatient care for patients undergoing RIV for prostate cancer, subject to specific conditions. The question arises: **can this model be replicated across Europe to ensure equitable access to internal vectorised radiotherapy for all patients?**

This was the central question of the event organized by the French representatives of nuclear medicine, held at the European Parliament on November 20, 2024. With the participation of healthcare professionals from France and Europe, as well as nuclear safety authorities, the event was supported by MEP Vlad Voiculescu (Renew, Romania) and attended by MEP Professor Laurent Castillo (EPP, France).

The objective of this event, organised with the support of the laboratory Advanced Accelerator Applications, was threefold: **to present the French outpatient care model; to explore the organisational implications for nuclear medicine centres; and to reflect on the European public policies** that should be developed to support the transformation of nuclear medicine.

Following remarks by MEP Vlad Voiculescu, which emphasised the need to overcome disparities in access to therapeutic innovations, the discussions were structured into four stages:

- A presentation by Pr Pierre-Yves Salaün (SFMN) on the challenges in nuclear medicine arising from the increase in internal vectorised radiotherapy activity.
- A first panel discussion on the outpatient care of patients and the associated regulatory challenges in radiation protection, featuring Pr Florent Cachin (CNPMN), Dr Géraldine Pina (ASN), Dr Arnaud Dieudonné (SFPM) and Dr Bérengère Dekyndt (SoFra).
- A second panel discussion on the organisational model of nuclear medicine centres, using the example of the Gustave Roussy Institute, featuring Pr Désirée Déandréis, Dr Louis Bertin (EAHP), and Pr Paola Anna Erba (EANM).
- A reflection by Pr Florent Cachin (CNPMN) and Pr Philippe Garrigue (CNP of Pharmacy) on European policies supporting the development of nuclear medicine.

MEP Laurent Castillo concluded the event by emphasising the need to assess the cost of these innovations for healthcare systems and the necessity of initiating a European-level discussion to ensure that European patients have access to these innovations and specialised centres.

The capacity of nuclear medicine centers and the shortage of professionals are two limiting factors for equitable access to internal vectorised radiotherapy in France and Europe.

By Pr Pierre-Yves Salaün, French Society of Nuclear Medicine.

The development and introduction of new radiopharmaceuticals drugs, particularly in oncology, is driving a major paradigm shift for nuclear medicine. Historically focused on diagnosis, this specialty is now positioning itself for the treatment of certain potentially high-incidence cancers. As a result, nuclear medicine centres are now tasked with managing an increasing number of patients.

To objectively assess this evolution and the associated needs, the French Society of Nuclear Medicine conducted a study in 2023-24 with nuclear medicine centers to provide a precise and structured overview of the strengths and weaknesses of the French healthcare system in accommodating these new therapies. The study, conducted with 79 centres, highlighted the willingness of healthcare professionals to offer internal vectorised radiotherapy. However, there was variability in the maturity of the centres: while one-third had already initiated internal vectorised radiotherapy, two-thirds had either planned to start the activity the following year or were still in the process of reflection.

Three key findings emerge from the SFMN capacity study:

- **Human resource shortages:** The main challenge for centres is recruitment difficulties, which affect all disciplines involved in the delivery of internal vectorised radiotherapy (radiographers, nurses, medical physicists, radiopharmacists, and nuclear medicine physicians). This issue is prevalent across all centres, regardless of their level of maturity.

- **Heterogeneity in the organisation of centers:** While the majority of centers offer outpatient care, others still provide the option to hospitalise patients. Additionally, nuclear medicine physicians are not always integrated into the patient's care pathway. Although 66% of centres reported participating in multidisciplinary team meetings, coordination with oncologists remains insufficiently standardised.
- **Need to invest in infrastructure and strengthen the medico-economic model:** Many centres still lack radiation-protected spaces in proportion to the number of eligible patients, as well as the necessary equipment for eligibility imaging. Furthermore, the medico-economic model is often seen as unprofitable, especially for centres considering starting this activity.

The SFMN study provides several recommendations:

- **Short-term:** Standardise practices, define common guidelines to organise the patient pathway, improve medical and nursing coordination, and develop radiation-protected infrastructures.
- **Medium-term:** Train more qualified personnel, support the opening of new centres capable of hosting these therapies, and anticipate needs in radiation protection and equipment.
- **Long-term:** Strengthen territorial coverage to increase overall care capacity by enabling more institutions to administer this type of therapy.

The outpatient care model, a French specificity that helps address the growing number of eligible patients.

Internal vectorised radiotherapy, an activity set to grow significantly in the coming years.
Pr Florent Cachin, National Professional Council of Nuclear Medicine.

The arrival of therapeutic innovations, particularly in the treatment of prostate cancer, is disrupting nuclear medicine by introducing a major scaling change. Currently focused on the treatment of thyroid cancers (around 15,000 cycles per year in France), internal vectorised radiotherapy activity will need to expand to include approximately 5,000 patients with prostate cancer, representing an additional 32,000 cycles. This increase requires a restructuring of the healthcare offering around theranostic centres capable of delivering these treatments on an outpatient basis, organising follow-up care, and managing radioactive waste, as well as a significant effort in recruiting healthcare professionals. Prostate cancer is just one example: research and development around these new radiopharmaceuticals are promising, with over two hundred clinical trials underway for various cancers (lung, pancreas, etc.) at all stages. It is essential to anticipate and prepare our healthcare system for the arrival of these innovations.

Outpatient care and radiation protection challenges.
Dr Géraldine Pina, Commissioner of the Nuclear Safety Authority

The advent of new radiopharmaceutical treatments (such as those labeled with lutetium) represents a "tipping point" for nuclear medicine. Historically, regulatory requirements were

designed for radioiodine therapy (iodine-131), which required hospitalisation in radiation-protected rooms for durations ranging from 24 hours to several days, depending on the administered activity, to ensure radiation protection for staff, the public, and the environment.

Faced with the diversification of lutetium-based treatment indications and the growing number of eligible patients without a corresponding increase in hospital capacity, the Nuclear Safety Authority updated the applicable regulatory framework while maintaining radiation protection standards. The 2020 circular on the evolution of nuclear medicine service authorisation for the possession and use of lutetium-177 now allows outpatient care with a six-hour patient stay in the nuclear medicine department after treatment administration. This circular also reaffirms the necessity of installing "decay tanks" to manage patient effluents.

Three key elements are crucial to ensure radiation protection:

1- **Facility compliance:** Radiation-protected rooms or boxes are used to safeguard staff. Their use depends on the radionuclide involved. While hospitalisation will remain necessary for some treatments, reducing prolonged stays in favor of outpatient activity is being considered based on the patient's emitted dose rate. Good practice dictates that patient discharge is permitted when the dose rate falls below 20 microsieverts/hour.
2- **Effluent management:** French regulations require facilities to connect to tanks that collect patient effluents (urine). The objective is to allow decay management before discharge. Decay management applies to radionuclides with half-lives under 100 days, including lutetium-177. This practice reduces worker exposure, particularly for sewage workers, considered the most exposed downstream population. To monitor radiation exposure, IRSN developed the CIDDRE tool to evaluate received doses. Radionuclides with half-lives exceeding 100 days cannot use decay management, posing challenges for handling such long-lived contaminants, which require specialised disposal.
3- **Management of radiocontaminated waste:** Waste from radionuclides with half-lives under 100 days is also managed by decay. In outpatient settings, radiocontaminated waste, particularly diapers and urinary protection for incontinent patients, must be stored at home for ten half-life (approximately 70 days for lutetium-177) before disposal with household waste. It is crucial to educate patients about proper waste management, as incorrect disposal could trigger radiation detection systems at waste treatment facilities. For radionuclides with half-lives over 100 days, decay management is not allowed, and waste must be managed by ANDRA.

At the national level, ASN highlights two key concerns:

1. Anticipating the increased number of treated patients and managing contaminated waste generated at home, including considerations for collection logistics and financing. A vision for "out-of-hospital nuclear medicine services" involving all stakeholders must be developed.

2. A shared reflection on the "ideal nuclear medicine service of the future" is needed to anticipate upcoming requirements and regulatory frameworks.

At the European level, two priorities emerge:

- **Acquiring radioprotection data early in the development of new radiopharmaceuticals**: Regulatory authorities require comprehensive information (radiation, dosimetry, effluents, waste) as early as possible to address radioprotection challenges. Recommendations in France have urged investigator centres and trial sponsors to provide complete data for radioprotection evaluation and to integrate radioprotection considerations at the earliest stages of radiopharmaceutical development.
- **Strengthening the connection between pharmaceutical legislation and radioprotection standards**: The lack of alignment between these domains complicates the establishment of a robust, harmonised regulatory framework. Discussions are ongoing within HERCA (Heads of the European Radiological Protection Competent Authorities) to promote a coherent regulatory approach across Europe.

Managing effluents and raising patient awareness about the handling of radiocontaminated waste are two major challenges in outpatient care.
Dr Arnaud Dieudonné, French Society of Medical Physics

The development of outpatient care must be carried out within the framework established by the Nuclear Safety Authority, particularly regarding the radioprotection of those around the patient, the public, and the environment.

Three aspects must be given attention:

1. **Effluent Collection**: In the case of Lutetium PSMA, the elimination of radioactivity is primarily urinary. Four hours after injection, 50% of the activity is eliminated. The challenge, therefore, is to collect the urine during the first hours, with the requirement not to release it into the environment. In this regard, it is crucial to have retention tanks to collect the urine and release it into the sewage system when the radioactivity is below 100 Bq/liter. For centres already administering internal vectorised radiotherapy, storage capacities are usually sufficient to meet regulatory requirements, as the tanks were installed for iodine-131 treatments. For centres starting these new therapies, they must install retention tanks and anticipate the future management of new radionuclides, such as alpha therapy.The use of the CIDDRE tool helps to feed the impact study and demonstrate that a new therapeutic activity or an increase in the capacity for therapeutic activities will not lead to significant exposure for sewer workers, provided that the annual dose limit of 1 mSv is respected.
2. **Therapeutic Patient Education**: Radioactive waste can be generated at home, particularly in incontinent patients. Clear guidelines for temporary storage must be provided to prevent these waste materials from being improperly processed in conventional waste systems (incinerators, landfills), potentially triggering radiation alarms. Therapeutic support for the patient is therefore crucial, taking into account their living conditions (housing, storage capabilities).
3. **Radiation Protection for Family Members and Healthcare Providers**: The French Society of Nuclear Medicine and the French Society of Medical Physics have developed a tool to recommend contact restrictions for patients with high-risk individuals (i.e., children, pregnant women). Using a methodology that takes into account the dose rate at

the source and the type of radiopharmaceutical, personalised recommendations can be provided.

Focus on early access, another feature of the French healthcare system.

Dr Bérengère Dekyndt, French Society of Radiopharmacy

French regulations permit early and exceptional access to certain innovative medications before they are widely available. This measure accelerates the introduction of new treatments to French patients, particularly in oncology, when other treatment options are unavailable and delaying the treatment is not an option. According to the National Agency for the Safety of Medicines, this early access reduces the waiting period for official treatment by an average of nine months, providing patients with faster access to innovation.

Compassionate use

A second mechanism, compassionate use, ensures continuity of care in the event of a supply disruption. Upon request from a healthcare professional, specialised hospital preparations can be authorised to address a shortage and guarantee the availability of the treatment.

The case of radiopharmaceuticals

Access to these radiopharmaceuticals is also subject to strict requirements in terms of radioprotection and dosimetry. Solid scientific data is required by the authorities to benefit from compassionate use.

Towards European Harmonization

At the European level, the demands of authorities regarding drug safety or nuclear safety can vary significantly and influence the timelines for accessing radiopharmaceutical innovations. A broader and earlier sharing of scientific data by suppliers and manufacturers would facilitate obtaining authorisations and standardise access to innovations across Europe. Improved coordination and pooling of this information could be the key to more equitable and faster access to innovative radiopharmaceuticals.

What organizational model for nuclear medicine centers?

The model of the Gustave Roussy Institute in internal vectorized radiotherapy

Pr Désirée Déandréis, Gustave Roussy Institute

The Gustave Roussy Institute is Europe's leading cancer centre, treating over 50,000 patients annually. The institute adheres to a philosophy of ultra-personalised care, with internal vectorised radiotherapy (RIV) emerging as a key pillar of its therapeutic offerings. The rapid development of this new treatment modality requires a flexible, efficient, and continuously evolving organisational

structure. To achieve this, the Institute has developed a method called "ALCOVE," which is based on several key areas:

- **Awareness:** Recognising the increasing number of patients eligible for this treatment.
- **Logistics:** Adapt the supply, preparation, and distribution circuits for treatments from today, in order to be prepared for the coming years.
- **Coordination:** Strengthening the links between nuclear medicine, oncology, and other departments (radiopharmacy, medical physics, nursing care, technicians) to streamline the patient journey.
- **Optimisation:** Enhancing the quality and agility of processes, increasing the number of patients treated without compromising safety or care quality.
- **Vigilance of frameworks:** Defining clear protocols and regularly reviewing the organisation to ensure a controlled ramp-up.
- **Education and evolution:** Implementing training programmes for all professionals involved (nuclear medicine physicians, radiopharmacists, medical physicists, nurses, technicians) and anticipating future needs.

At the Gustave Roussy Institute, this method has enabled:

- Creation of "fast-track" programmes to ensure quick access to imaging followed by treatment.
- Establishment of dedicated teams with a coordinator to define the patient pathway and clarify the responsibilities of involved members.
- Development of a training programme for nuclear medicine staff as well as external personnel to establish a multidisciplinary team focused on RIV.

This organisational model developed at Gustave Roussy is intended to be shared both nationally and across Europe.

The Radiopharmacist: A Central Player in the Supply, Preparation, and Patient Support for Radiopharmaceuticals

Dr Louis Bertin, European Association of Hospital Pharmacists

The radiopharmacist plays a vital role in patient, ensuring that the right medication is delivered at the right dose, at the right time, through the appropriate route of administration, and at an optimal cost. Due to the specific characteristics of radiopharmaceuticals (radioactivity, regulatory constraints, etc.), this task is particularly complex and relies on three pillars:

1- **Supply Management:** This involves ordering, receiving, storing, and managing the inventory of radiopharmaceuticals. Additionally, radiopharmacists contribute to clinical research and trial implementation (investigational dossiers, etc.), thereby promoting access to innovation.
2- **Production:** Preparing radiopharmaceuticals under stringent aseptic and quality conditions, ensuring safety and consistent quality. Hospital (radio)pharmacists are key to guaranteeing the quality of radiopharmaceuticals.

3- **Patient Support:** Informing and guiding patients, particularly when treatment is administered in outpatient settings outside traditional hospital care.

The ability to successfully transition to an outpatient model depends on the development level of these three pillars, which varies across European countries. **It is essential to have sufficiently developed radiopharmacy infrastructures to ensure patient access to innovation.**

Shifting to an outpatient model requires raising patient awareness about their therapy and its implications, as they will spend less time under hospital supervision. Patients often have questions about side effects, handling, and radiation protection. In France, initiatives already exist where radiopharmacists meet with patients to explain treatment procedures, precautions, and associated costs. These consultations are highly valued by patients and are key to evaluating treatment outcomes and identifying contraindications due to adverse effects. This role is referred to as clinical radiopharmacy activity.

The development of Radiopharmaceutical Internal Vectorisation (RIV) will require a sufficient number of radiopharmacists and broader dissemination of expertise—currently concentrated in a few specialised centres—across more institutions. Effective coordination with other healthcare professionals (nuclear physicians, medical physicists, etc.) is also indispensable.

Promote cooperation among stakeholders to facilitate patient access to treatments.

Pr Paola Anna Erba, European Association of Nuclear Médecine

The development of targeted internal radiotherapy is generating significant hope among both patients and healthcare professionals. However, this is occurring at a time when considerable differences exist between European countries. To ensure equitable and rapid access to these innovations, it is essential to overcome administrative, regulatory, and logistical barriers, with a focus on a multidisciplinary and interdisciplinary approach. In this context, the involvement of both healthcare professionals and nuclear safety authorities is necessary to remove obstacles, harmonise practices, and develop better organisational models, such as the one seen at the Gustave Roussy Institute. Ambulatory care is crucial, provided the patient's health status, family environment, and personal organisation allow for it.

Moreover, the shortage of personnel is a major European issue that must be addressed in order to ensure access to targeted internal radiotherapy (RIV).

What policy to support access to innovation in nuclear medicine within the European Union?

By Pr Florent Cachin, National Professional Council of Nuclear Medicine, and Pr Philippe Garrigue, National Professional Council of Pharmacy and French Society of Radiopharmacy.

The rapid development of radioligand therapy in cancer care is a pressing issue that will intensify in the coming years with the arrival of new radionuclides and an increasing number of eligible patients. Anticipating and organising structures are key to ensuring patient access to these new therapies. At the European level, this must be addressed on several fronts:

1- **Clearly identify innovation in nuclear medicine within cancer plans** to allocate funding and support the structuring of the sector and centres, whether public or private.
2- **Address the healthcare workforce shortage by forecasting recruitment challenges in all disciplines involved in radiopharmaceutical therapies:** nuclear medicine physicians, radiopharmacists, medical physicists, and technicians. Tailoring training (both initial and ongoing) to emerging technologies is essential for fostering the growth of RIV.
3- **Promote innovation in nuclear medicine** by developing targeted calls for projects. Nuclear medicine may suffer from a lack of recognition and often finds itself competing with other projects for funding.
4- **Secure the supply chain and build a true sector.** The coordination of all stakeholders (industry, decision-makers, healthcare professionals) is key to ensure the availability of radionuclides and structure the radiopharmaceutical supply chain.
5- **Evolve regulatory frameworks.** Generating robust data is key for helping authorities align policies with evolving needs, especially as new compounds emerge and necessitate outpatient care validation.
6- **Ensure equitable access to therapeutic innovations.** In this regard, France is fortunate to have developed two important mechanisms: compassionate access and early access, which allow patients to benefit from early access to innovation. At the same time, the outpatient model represents a real opportunity for patients.

List of interventions:

Vlad Voiculescu, Member of the European Parliament, Renew Group, Romania.

Pr Laurent Castillo, Member of the European Parliament, European People's Party, France.

Pr Pierre-Yves Salaün, Nuclear Medicine Specialist, CHU de Brest – Member of the French Society of Nuclear Medicine.

Pr Florent Cachin, Nuclear Medicine Specialist, President of the National Professional Council of Nuclear Medicine.

Dr Géraldine Pina, Commissioner, Nuclear Safety Authority.

Dr Arnaud Dieudonné, Medical Physicist, Vice President of the French Society of Medical Physics.

Dr Bérengère DEKYNDT, Radiopharmacist, General Secretary of the French Society of Radiopharmacy.

Pr Désirée Deandreis, Nuclear Medicine Physician, Gustave Roussy Institute.

Dr Louis Bertin, pharmacien hospitalier, EAHP Board Member

Pr Paola Anna Erba, Elected President of the EANM Board

Pr Philippe Garrigue, AP-HM / AMU, Radiopharmacist, Vice-President of the French Society of Radiopharmacy – Member of the National Professional Pharmacy Council.

Glossary:

ALCOVE: Awareness, Logistics, Coordination, Optimisation, Vigilance of frameworks, Education et Evolution

ANDRA: Agence Nationale pour la gestion des Déchets Radioactifs

ASN: Nuclear Safety Authority

Bq: Becquerel

BSS: Basic Safety Standards

CIDDRE: Calculation of the Impact of Radioactive Discharges in Networks

CNPMN: National Professional Council of Nuclear Medicine

CNP of Pharmacy: The National Professional Council of Pharmacy

EAHP: European Association of Hospital Pharmacists

EANM: European Association of Nuclear Medicine

IRSN: Institute for Radiological Protection and Nuclear Safety

PSMA: Prostate-Specific Membrane Antigen

PPE: European People's Party

RIV: Internal vectorized radiotherapy

SFPM: French Society of Medical Physics

SFMN: French Society of Nuclear Medicine

SoFra: French Society of Radiopharmacy