EU Policy & Projects
by the European Association of Nuclear Medicine

Nuclear Medicine
What it is.
Where it goes.
What it needs.

Overarching Narrative 2026

About the EANM and this Document

The European Association of Nuclear Medicine (EANM) is a professional, non-profit organisation representing the nuclear medicine community across Europe. It brings together a multidisciplinary community of physicians, scientists, technologists, medical physicists, radiopharmacists, and other healthcare professionals with a shared mission to improve patient outcomes through safe, high-quality, accessible, cost-effective, and sustainable nuclear medicine.

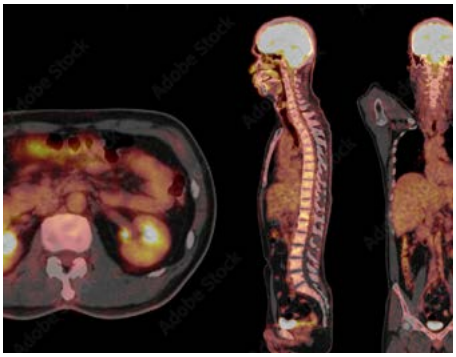
Through education, research, clinical guidance, and policy engagement, and working with key stakeholders such as patient organisations, sister organisations of other medical specialities, European biomedical umbrella organisations, nuclear medicine industry, regulators, and policymakers, the EANM strengthens everyday clinical practice and accelerates the clinical translation of innovation into routine patient care. It supports clinical trials and evidence generation, promotes equitable access across countries and regions, and helps ensure that new technologies and radiopharmaceuticals reach patients faster, with consistent, high standards across Europe.

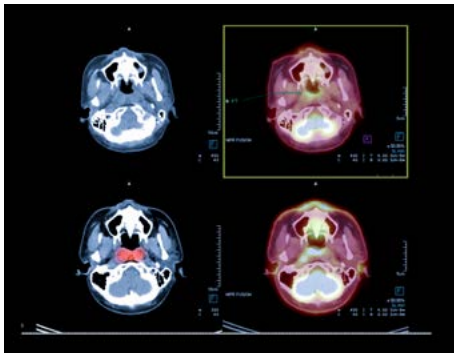
This document provides an overview of nuclear medicine, explaining what it is, why it is unique, and how it contributes to precision medicine and personalised healthcare. It aims to build understanding among non-specialist audiences, from policymakers and patient organisations to journalists and the wider public, while highlighting the opportunities, challenges, and policy priorities shaping the future of the field in Europe.

What is Nuclear Medicine? Why is it unique?

Nuclear medicine is a specialised medical field that uses **radiopharmaceuticals**[1]. Radiopharmaceuticals are radioactive compounds designed to selectively localise in specific tissue types to diagnose, treat, and monitor a wide spectrum of diseases.

Unlike *radiology*, which primarily provides structural imaging, or *radiation oncology*, which delivers external radiation for treatment, *nuclear medicine* provides functional and molecular information by enabling the visualisation and quantification of **physiological and molecular processes** within the body.





Each year, approximately **10 million** nuclear medicine procedures are performed across Europe[2,3]. The main clinical application is **oncology**, where nuclear medicine plays a central role in disease detection and staging, therapy selection, and treatment response assessment. Major applications are also found in **cardiology**, particularly for the evaluation of myocardial perfusion and viability, and in **neurology**, where it contributes to the differential diagnosis of neurodegenerative disorders. Additionally, nuclear medicine techniques are increasingly applied in **other clinical domains**, including endocrinology, infection and inflammation imaging, surgery, orthopaedics, and rare diseases. These procedures are performed in more than 1,500 nuclear medicine centres throughout Europe[3], highlighting the crucial and integral role of nuclear medicine in current patient care.

What makes nuclear medicine truly unique is its ability not only to **visualise how organs and tissues function at the molecular level**, but also to **deliver targeted treatments directly to diseased cells**. This combination of "seeing and treating" within the same framework positions nuclear medicine as a cornerstone of **precision and personalised medicine**.

The field is entering a period of rapid transformation. While approximately 90% of current procedures focus on diagnostics[4], the coming years are expected to see a **significant expansion of therapeutic applications**, particularly with the rise of **theranostics**[5] and targeted **radioligand therapies**[6], also commonly referred to as radiopharmaceutical therapy[7]. This evolution will reshape nuclear medicine into an even broader medical discipline, integrating both diagnosis and targeted treatment to improve patient outcomes.

Diagnostics

After administering a radiopharmaceutical, **imaging techniques** such as PET or SPECT, often combined with CT or MRI, capture the distribution of the radiotracer, providing **detailed images** of physiological functions and molecular targets.

Therapy

Therapies (such as radioiodine therapy for thyroid cancer and ^{177}Lu-labelled peptides for neuroendocrine tumours) involve **administering radiolabelled compounds** that deliver **targeted radiation to diseased tissues**, minimising damage to surrounding healthy cells.

Theranostics

It **combines diagnostic and therapeutic capabilities** by using the same radiopharmaceutical for both imaging and treatment. This strategy ensures that only patients with the **appropriate molecular targets** receive specific therapies.

Multidisciplinarity as a Defining Feature

Nuclear medicine is inherently **multidisciplinary**, relying on close collaboration between professionals with diverse expertise to maximise clinical outcomes:

- **Nuclear Medicine Physicians:**
  Oversee patient care and interpret imaging results.
- **Medical Physicists:**
  Ensure optimal imaging quality and radiation safety.
- **Radiochemists and Radiopharmacists:**
  Develop and produce radiopharmaceuticals.
- **Technologists and specialised nurses:**
  Operate imaging equipment and assist in patient management.
- **Clinical Specialists:**
  Collaborate across different medical domains to integrate nuclear medicine findings into broader diagnostic and therapeutic strategies.

The imaging tools of Nuclear Medicine

Nuclear medicine employs various imaging modalities to visualise the in vivo distribution of radiopharmaceuticals within the body. Only small quantities of these compounds are required to generate high-quality diagnostic images, as the imaging systems have very high sensitivity and can detect very low levels of emitted radiation. As a result, despite the use of radiopharmaceuticals, nuclear medicine imaging is generally associated with low radiation exposure and a very favourable safety profile.

Positron Emission Tomography (PET)

PET utilises positron-emitting radionuclides, such as ^{18}F, to provide high-resolution, quantitative images of tracer distribution. A full ring of detectors surrounds the patient and detects pairs of photons emitted simultaneously, following the interaction of the positrons with the electrons in the patient's body. In current clinical practice, PET is combined with CT or MRI to offer comprehensive anatomical and functional information. The radioisotopes used for PET are produced by cyclotrons and, for nuclides with sufficiently long half-lives, can be distributed

to regional radiopharmacies supplying multiple hospitals. The main clinical application of PET is whole-body oncologic imaging, particularly for disease staging and patient stratification using the ^{18}F-labelled glucose analogue fluorodeoxyglucose (FDG), which highlights tissues with increased glucose metabolism, such as many cancers.

Recent technological developments include **long axial field-of-view (LAFOV) PET scanners**[8,9] which substantially extend the detector coverage along the patient's body. Systems approaching total-body coverage represent the most advanced examples of this technology, pushing the limits of sensitivity and enabling faster scans, lower injected activity, and novel whole-body dynamic imaging applications[10]. However, LAFOV PET is currently available only in a limited number of centres.

Single Photon Emission Computed Tomography (SPECT) and Planar Scintigraphy

Single Photon Emission Computed Tomography (SPECT), often referred to as conventional nuclear medicine, remains the most widely performed nuclear medicine imaging technique. It detects gamma-emitting radionuclides, such as ^{99m}Tc, using a rotating gamma camera to acquire signals from multiple angles around the patient, which are then reconstructed into three-dimensional images. SPECT is widely used in cardiology, bone imaging, and neurology. Planar scintigraphy uses the same gamma camera technology but acquires two-dimensional static or dynamic images. It remains valuable for specific indications, including thyroid imaging and renal function studies. ^{99m}Tc is produced locally from ^{99}Mo/^{99m}Tc generators, enabling on-demand preparation of many SPECT tracers; however, because ^{99}Mo must be produced in nuclear reactors, the supply chain is a known vulnerability.

Recently, **3D SPECT systems**[11] based on solid-state detectors have been introduced; these offer higher sensitivity and energy resolution, enabling faster scans and lower injected activity than conventional gamma-camera systems, while improving image quality and quantitative performance.

Hybrid imaging systems, such as PET/CT, PET/MRI, and SPECT/CT, are now the standard commercial configurations in nuclear medicine. By combining functional information from nuclear medicine with high-resolution anatomical imaging, these systems significantly enhance diagnostic accuracy and clinical confidence.

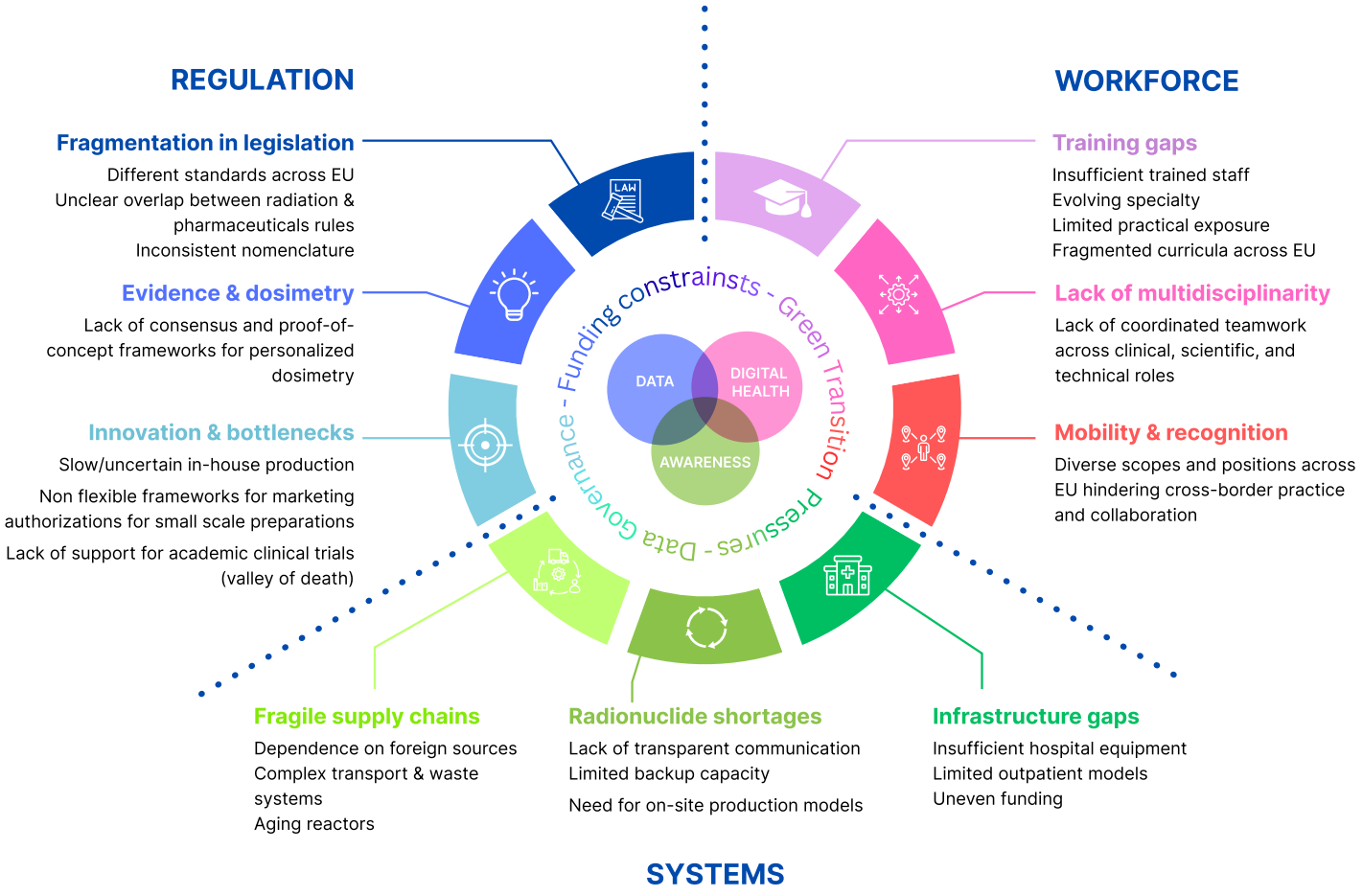
From imaging to radionuclide therapy

A defining strength of nuclear medicine is the direct translation from diagnostic imaging to targeted radioligand therapy. Diagnostic procedures can be used to non-invasively confirm the in vivo expression of specific biological targets, such as receptors, transporters, or metabolic pathways. Once sufficient target expression and radiopharmaceutical uptake have been demonstrated, the same molecular targeting vector can be used for therapy by replacing the diagnostic radionuclide with a therapeutic one and administering higher activities to deliver a cytotoxic radiation dose to diseased cells or tissues. This paired diagnostic–therapeutic approach, referred to as **(radio)theranostics**[12], enables patient selection, treatment planning, and therapy monitoring within a unified framework. By ensuring that treatment is offered only to patients whose disease demonstrates appropriate target expression, radiotheranostic strategies support personalised care while limiting unnecessary toxicity.

Targeted radioligand therapy typically employs beta- or alpha-emitting radionuclides with physical properties suitable for therapy, including longer half-lives that allow for centralised, often reactor-based, production and subsequent distribution to specialised centres. Through this close integration of imaging and therapy, nuclear medicine extends beyond diagnosis to deliver targeted, mechanism-based treatments and reinforces its central role in precision medicine.

Challenges in Nuclear Medicine

The landscape of Nuclear Medicine in Europe is shaped by **interconnected challenges** spanning **regulation, workforce, and systems**. Barriers like fragmented legislation, training and mobility gaps, limited multidisciplinary collaboration, supply chain vulnerabilities, and infrastructure constraints continue to interfere with the field's growth and impact. At the same time, **cross-cutting issues**, including funding constraints, digital transformation, data governance, and sustainability demands, further influence the ability to deliver innovative, high-quality care. Addressing these challenges would ensure the **sustainable development of Nuclear Medicine** and secure equitable access to advanced diagnostics and therapies across Europe.

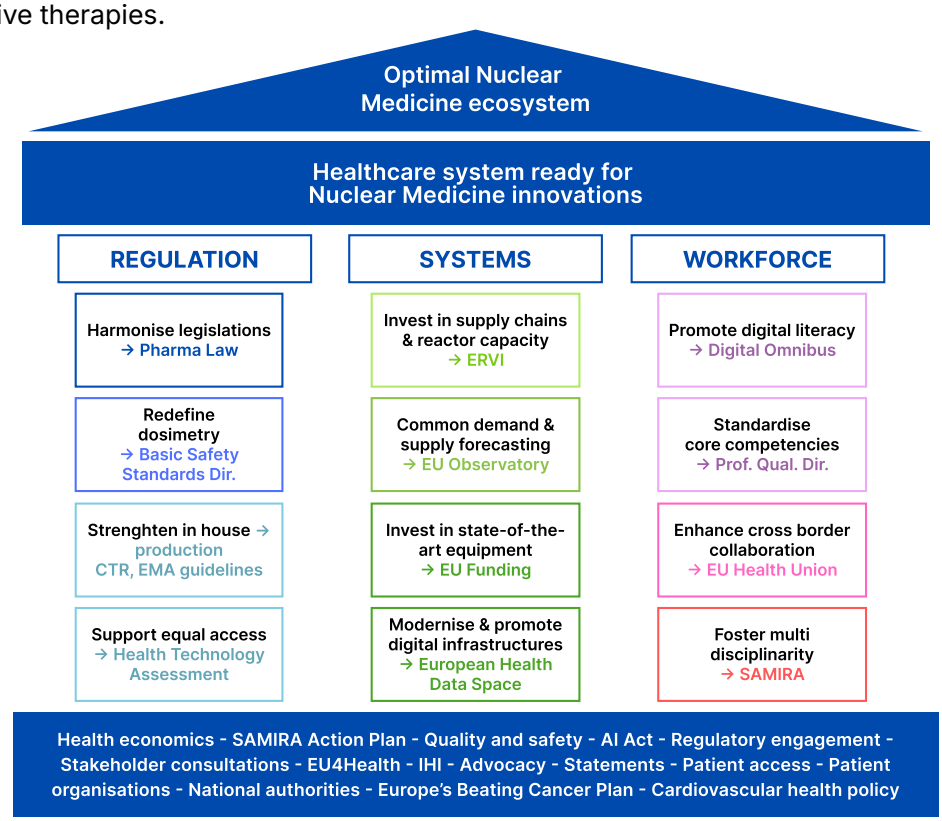


Safety and Regulatory Framework

Nuclear medicine procedures adhere to **stringent safety standards**. All procedures are performed under the supervision of qualified nuclear medicine physicians, ensuring patient safety and compliance with European and national regulatory guidelines. The **European Basic Safety Standards Directive**[13,14] mandates that all medical uses of ionising radiation, including nuclear medicine, be justified and optimised to minimise exposure while achieving the intended medical benefit. A central principle underpinning this framework is **ALARA** (*As Low As Reasonably Achievable)*[15], which guides the optimisation of administered activities and imaging protocols. The application of ALARA does not imply compromising diagnostic image quality or therapeutic effectiveness. Rather, it ensures that radiation exposure is tailored to the clinical question and patient characteristics, delivering doses that are sufficient to achieve accurate diagnosis or effective treatment while avoiding avoidable exposure.

The Policy Landscape

Across Europe, nuclear medicine has become increasingly important to personalised healthcare. As diagnostic and therapeutic innovations accelerate, policy and regulatory frameworks must evolve in parallel to ensure that patients can benefit from these advances in a timely, safe and equitable manner. Several European initiatives and legislations are redefining how innovation reaches the patients and how health systems prepare for these transformative therapies.



A key issue shaping this landscape is the **need for modernised and flexible regulation**. Current European rules governing radiopharmaceuticals and radiation protection were developed at different times and for different purposes, and often lack alignment, slowing innovation. A **fit-for-purpose regulatory framework, reconciling pharmaceutical and radiation safety demands would facilitate the translation of research into clinical practice while preserving safety and quality.** The recent revision of the EU Pharmaceutical Legislation presented a crucial opportunity to address long-standing gaps affecting radiopharmaceuticals. The EANM has consistently called for clearer, dedicated provisions reflecting the specific nature of these products, reducing administrative complexity and supporting in-house preparation. The nuclear medicine community hopes that the new Directive and Regulation will finally create a clearer, more coherent framework that facilitates innovation while ensuring patient access and safety. Complementary EMA guidelines on radiopharmaceuticals may further contribute to more tailored and efficient regulatory pathways.

Beyond regulation, Europe's fragmentation in reimbursement and access pathways remains a major barrier to timely and equitable patient care. A more coordinated interface between EU-level scientific assessment and national market-access processes is essential to strengthen predictability for innovators, ensure competitiveness and avoid disparities between Member States. EANM advocates for a coherent, innovation-friendly framework that supports sustainable adoption of nuclear medicine technologies across all Member States. As the new European Health Technology Assessment system is implemented, assessment methodologies must be adapted to the specific characteristics of nuclear medicine. Radioligand therapies require tailored evidence standards, expert input, and realistic expectations regarding study design. In both the European Health Technology Assessment Regulation and the Clinical Trials Regulation, the EANM is advocating for methodologies that acknowledge the unique clinical pathways, trial designs, and multistep production realities of radioligand therapies. This includes ensuring that joint clinical assessments incorporate nuclear medicine expertise and allow for flexible evidence requirements that remain scientifically robust without hindering access.

Scientific progress also depends on **deeper investment in radiobiology and personalised dosimetry,** fields that provide the biological and quantitative foundations for safe, effective targeted radionuclide therapies. **Strengthening these research areas and fostering consistent data collection** across countries will accelerate the development of more precise, patient-tailored treatments, matching the ongoing efforts of the European Medicines Agency's efforts with respect to the clinical evaluation of therapeutic radiopharmaceuticals in oncology. In this respect, the EANM continues to call for increased European funding opportunities dedicated specifically to radiobiology, dosimetry, and translational radioligand therapy research. Sustained EU-level investment, through Horizon Europe, the Innovative Health Initiative, and future research programmes, is essential to build scientific capacity, support multicentre studies, and ensure that Europe remains competitive in this strategically important field.

Another fundamental priority is **securing a stable supply of medical radioisotopes**, materials which underpin all nuclear medicine procedures. Recognising these materials as critical to healthcare and the strengthening of European production and distribution chains are prerequisites for uninterrupted patient care and supporting future therapeutic breakthroughs. The EANM supports initiatives such as the European Radioisotopes Valley Initiative (ERVI) and calls for the inclusion of key radioisotopes within the scope of the Critical Medicines Act, to deliver long-term structural solutions and greater resilience across Member States.

Finally, meaningful progress ultimately depends on a **well-trained and adequately resourced workforce.** Persistent disparities across the EU in training structures, workforce capacity, referral pathways, and access to advanced technologies risk undermining equitable patient care. **Coordinated investment in education, interdisciplinary collaboration, and system planning** will be crucial for ensuring that patients everywhere can benefit from the same high standard of care. At EU level, workforce development should be supported through initiatives such as the Professional Qualification Directive, cross-border training frameworks, and policies under the European Health Union promoting harmonised education standards and specialist mobility. Any legislative effort shaping future healthcare systems must explicitly account for skills development and long-term workforce planning in nuclear medicine.

In conclusion, all these elements provide a clear direction for the future: a more coherent regulatory environment, stronger supply chain resilience, smarter and fairer evaluation systems, deeper scientific investment, responsible digital innovation, and a well-supported workforce. By advancing these priorities, the EU can create the conditions for nuclear medicine to deliver its full potential, offering earlier diagnoses, more targeted treatments, and better outcomes for patients.

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