Diagnostic Imaging
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vizient

Theranostics: A new weapon against cancer

Cancer is the second-leading cause of death in the United States.[1] Its treatment is complicated because different cancers behave in different ways. A single treatment rarely works for everyone. However, a new approach called theranostics is changing how providers diagnose and treat cancer.

Theranostics combines diagnostic radiopharmaceutical imaging to find cancer and targeted radioactive therapy to treat it.[2] This method is already improving outcomes for many patients and is expected to play a larger role in cancer care moving forward.

How theranostics works

Theranostics allow clinicians to see what they treat and treat what they see.[3]

- Many cancer cells have unique proteins on their surface.
- Scientists attach a radioactive tracer to a molecule that binds to those unique proteins.
- Imaging such as PET or SPECT then reveals where the cancer is.
- The same molecule, paired with a different radioactive isotope, is used to deliver targeted therapy directly to the tumor.

Example: Neuroendocrine tumors (NETs)

Some NETs express somatostatin receptors (SSTR2). A PET scan using dotatate linked to a radioactive tracer identifies the tumor. The same molecule with a therapeutic isotope is then used to deliver radiation to the cancer cells, minimizing damage to healthy tissue.

A century of progress

The concept of theranostics isn't new. In 1921, Marie Curie explored the use of radium in cancer treatment.4 In the 1940s, Dr. Saul Hertz developed the use of radioactive iodine (I-131) to treat thyroid conditions. The FDA approved this therapy in 1951, making it the first dual-purpose radiopharmaceutical: I-123 for imaging and I-131 for treatment.[4] Today, theranostics is becoming recognized as the fifth pillar of cancer treatment, alongside surgery, chemotherapy, radiation therapy and immunotherapy.[3]

Theranostics in prostate cancer

Theranostics is now making significant strides in prostate cancer care. Advanced prostate cancers often express a protein called prostate-specific membrane antigen (PSMA). PSMA PET scans can detect these tumors. If positive, patients may be eligible for Lutetium-177 vipivotide tetraxetan, a targeted therapy that binds to PSMA and delivers radiation to the cancer cells.

Monitoring results

After therapy:

- CT, MRI and bone scans evaluate response.
- SPECT scans performed shortly after a therapy dose allow for assessment of therapy delivery and response.[3]
- Dosimetry calculates radiation absorbed by the body and helps predict outcomes. It can be correlated with a patient's prostate-specific antigen level and to assess therapy effectiveness.[2]

A promising future

Theranostics is growing rapidly. According to Sg2, radiopharmaceutical therapy is projected to grow by 20% over the next decade.[5] This growth is fueled by:

- Earlier use in treatment pathways (e.g., prostate cancer)
- Expanded indications (e.g., renal cancer)
- Development of additional alpha-emitting radiopharmaceuticals (e.g., Ac-225 and Pb-212)
- Increased use in combination with other therapies

Diagnostic growth

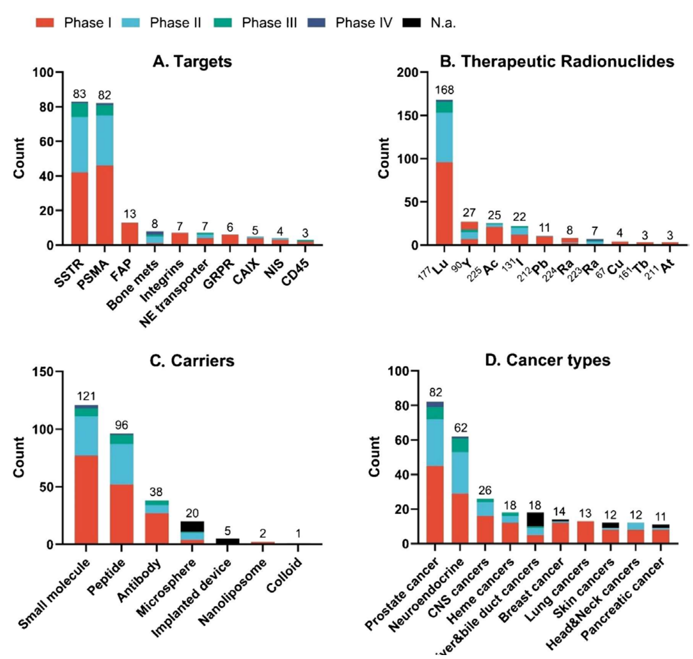
- PET is projected to grow 23% over the next 10 years[5]
- SPECT is projected to grow 8% over the next 10 years[5]

These modalities are essential for staging, treatment planning and evaluating response. In many cases, they provide clearer confirmation of drug delivery than lab values.

Clinical trials and education

Clinical trial activity is increasing, opening more opportunities for patients to access emerging

therapies and for institutions to participate in research. Technologists and providers involved in trials can benefit from the Society of Nuclear Medicine and Molecular Imaging Clinical Trials Network Research Series, which provides tools and training to support best practices.[2]



Tran HH, Yamaguchi A, Manning HC. Radiotheranostic landscape: a review of clinical and preclinical development. Eur J Nucl Med Mol Imaging. Published online Feb. 1, 2025. doi:10.1007/s00259-025-07103-7

FDA-approved radiopharmaceutical therapies

In the U.S., the following radiopharmaceutical therapies are approved by the FDA:

- **Iodine-**131 for hyperthyroidism and thyroid cancer
- **Lutetium-**177 dotatate for somatostatin receptor-positive GEP-NETs
- **Lutetium-**177 vipivotide tetraxetan for PSMA-positive metastatic prostate cancer [10]
- **Yttrium-** 90 microspheres for hepatocellular carcinoma

Many ongoing trials aim to expand these therapies to other cancers, with the goal of making treatment more precise and less toxic.

Strategic considerations for health systems

As adoption grows, health systems will need to invest in infrastructure, staffing and process improvements to support theranostics effectively. Some common challenges and potential solutions are listed below:

1. Expand imaging and treatment capacity

Access to PET/CT, PET/MRI and SPECT remain a limiting factor. Imaging bottlenecks can delay treatment.

Action steps:

- Evaluate throughput and referral wait times
- Consider co-locating nuclear medicine and oncology services
- Extend imaging hours to reduce backlogs

2. Plan for radiopharmaceutical supply chain

Theranostics adds complexity to the supply chain due to short isotope half-lives, as well as a demand that exceeds the current supply.

Action steps:

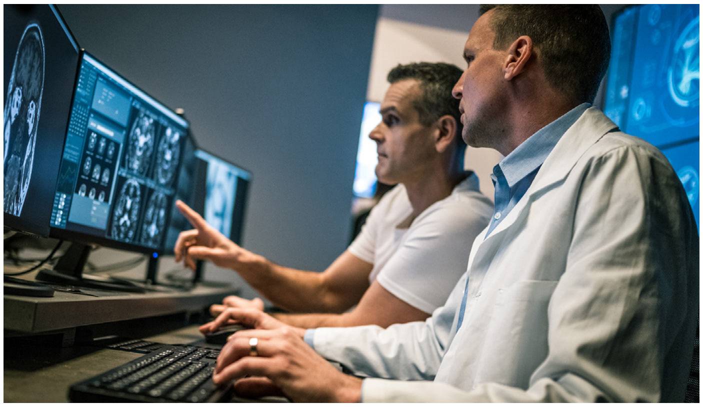
- Closely work with radiopharmacies to coordinate dose orders and communicate regarding any changes
- Consider establishing relationships with both primary and secondary radiopharmaceutical distributors for increased supply assurance[5]

3. Build a skilled, collaborative workforce

Theranostics requires collaboration across disciplines. Medical oncologists need familiarity with nuclear imaging and radiopharmaceuticals. Nuclear medicine physicians should understand cancer treatment pathways. There's also rising demand for nuclear medicine technologists, dosimetrists, pharmacists, radiologists and radiation safety officers to collaborate.

Action steps:

- Encourage cross-specialty collaboration through joint case reviews and educational sessions
- Offer targeted training and continuing education in theranostics
- Invest in onboarding programs that include both clinical and operational perspectives
- Create career development pathways to retain and grow talent in nuclear medicine and oncology



4. Streamline referral pathways

Fragmented referral processes can delay or prevent access to therapy.

Action steps:

- Align urology, endocrinology, radiation oncology and medical oncology around standardized criteria
- Map existing referral patterns to identify barriers or gaps
- Create shared workflows and clear triage protocols
- Promote coordination across specialties and expanded sites of care

Best practice: Form a Theranostics Tumor Board to improve patient selection and promote coordination across specialties.

Conclusion

Theranostics is reshaping the future of cancer care. By combining imaging and treatment into a single, personalized approach, it offers clinicians a powerful new way to treat patients more precisely and effectively. Vizient aims to bring providers value in this space through its partnerships with market-leading radiopharmacies, as well as with manufacturers of radiopharmaceuticals. Vizient also has a vast network of subject matter experts, both internally and across the industry.

For health systems and providers, the path forward will require investments in infrastructure, workforce development and collaborative care models. However, the reward is significant: better outcomes, safer therapies and the opportunity to lead in delivering the next generation of cancer treatment.

References

1. Song Y, Zou J, Castellanos EA, et al. Theranostics – a sure cure for cancer after 100 years? Theranostics. 2024;14(6):2464-2488. doi:10.7150/thno.96675
2. Tran HH, Yamaguchi A, Manning HC. Radiotheranostic landscape: a review of clinical and preclinical development. Eur J Nucl Med Mol Imaging. Published online Feb. 1, 2025. doi:10.1007/s00259-025-07103-7
3. Burkett BJ, Bartlett DJ, McGarrah PW, et al. A review of theranostics: perspectives on emerging approaches and clinical advancements. Radiology Imaging Cancer. 2023;5(4):e220157. doi:10.1148/rycan.220157
4. Vu TM, Loveday, BPT, Behrenbruch C, Hollande F, Heriot AG. Theranostics: a fifth pillar of contemporary cancer care? ANZ J Surg. 2022;92(11):2782-2783. doi:10.1111/ans.17873
5. Sg2. Impact of Change®, 2025; Proprietary Sg2 All-Payer Claims Data Set, 2023; 2023 CMS Limited Data Sets (LDS); Claritas Pop-Facts®, 2025; Sg2 Analysis, 2025.