

Rapid Technology Scan: Radioligand Technologies

May 2021



Background: NIHR Innovation Observatory

- Horizon scanning centre based at Newcastle University
- Delivering horizon scanning and early awareness notification service to national healthcare bodies within the UK
- Identifying promising health innovations: medicine, medical devices, diagnostics and digital technologies
- Working closely with the Accelerated Access Collaborative (AAC), and national bodies such as NHS E&I and NICE, UK HSA to support accelerated access of new innovative health technologies and services to NHS patients



Objectives & Scope

- The Innovation Observatory (IO) sought to:
 1. Undertake a rapid horizon scan for radioligand technologies and identify the pipeline of development, key players, opportunities and challenges in the field (globally)
 2. Summarise key findings regarding the outcomes of this scan and evidence gathered from business intelligence and grey literature
- This scan was carried out to increase understanding of the pipeline of radioligand products and the infrastructure required to support these products in a healthcare setting
- To be considered as part of this scan, the technology must contain a radioactive isotope and a ligand, customised for diagnostic (imaging) and/or therapeutic (treatment) purposes.
- Radioligand therapy is most commonly used for cancer treatment and diagnosis, however radioligand technologies designed to treat other diseases were also considered for this scan

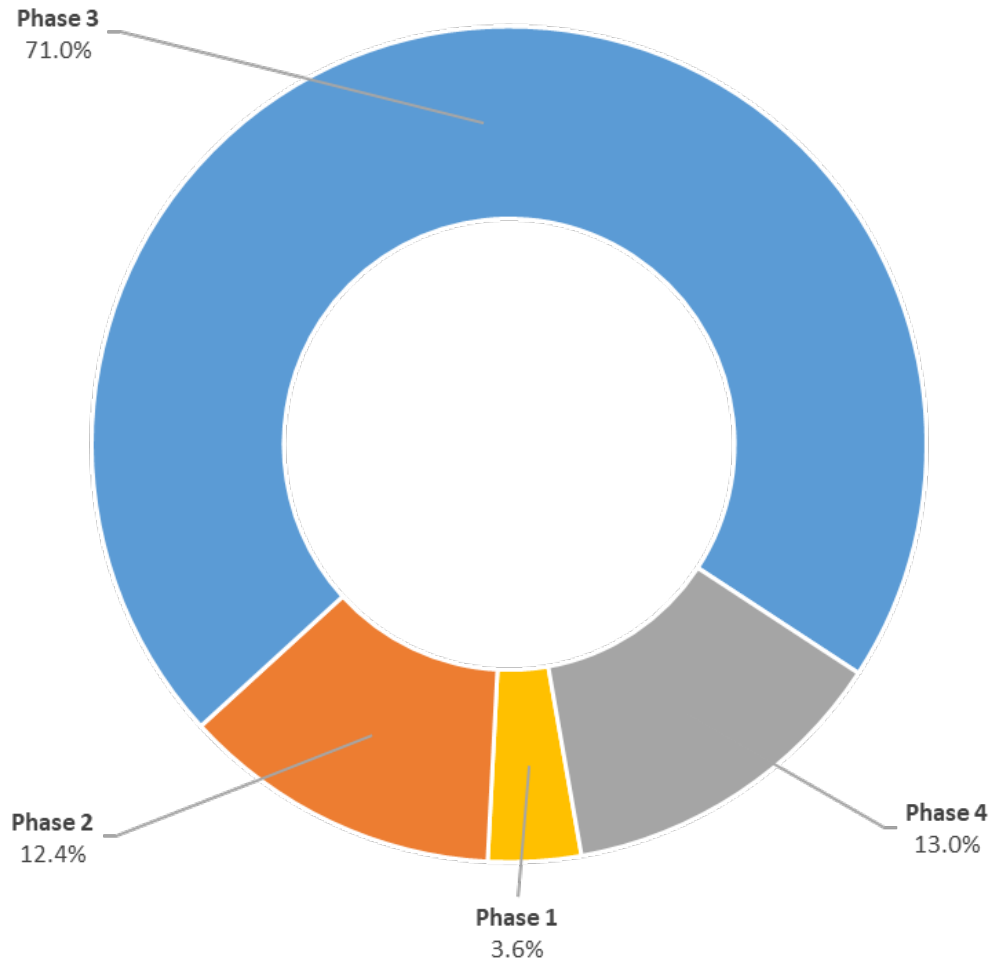
Methods

- For the purposes of this rapid technology scan:
 - IO developed a detailed dataset of technologies by formulating search strategies for PRS, based on a comprehensive list of terms with input from expert panels
 - Primary and secondary sources were systematically scanned using a combination of traditional scanning methods, automated and novel AI/machine learning techniques
 - Screened results and extracted intelligence was used in further data processing
- Information sources used as part of this scan included, *inter alia*:
 - Bibliographic databases, including PubMed, EMBASE and MEDLINE
 - MedTech news websites
 - Commercial websites, reports and press releases
 - Academic institution webpages
 - IO [ScanMedicine](#) trial database (11 clinical trial registries including UK, EU, USA)
 - Patent databases
 - Regulatory agency

Limitations

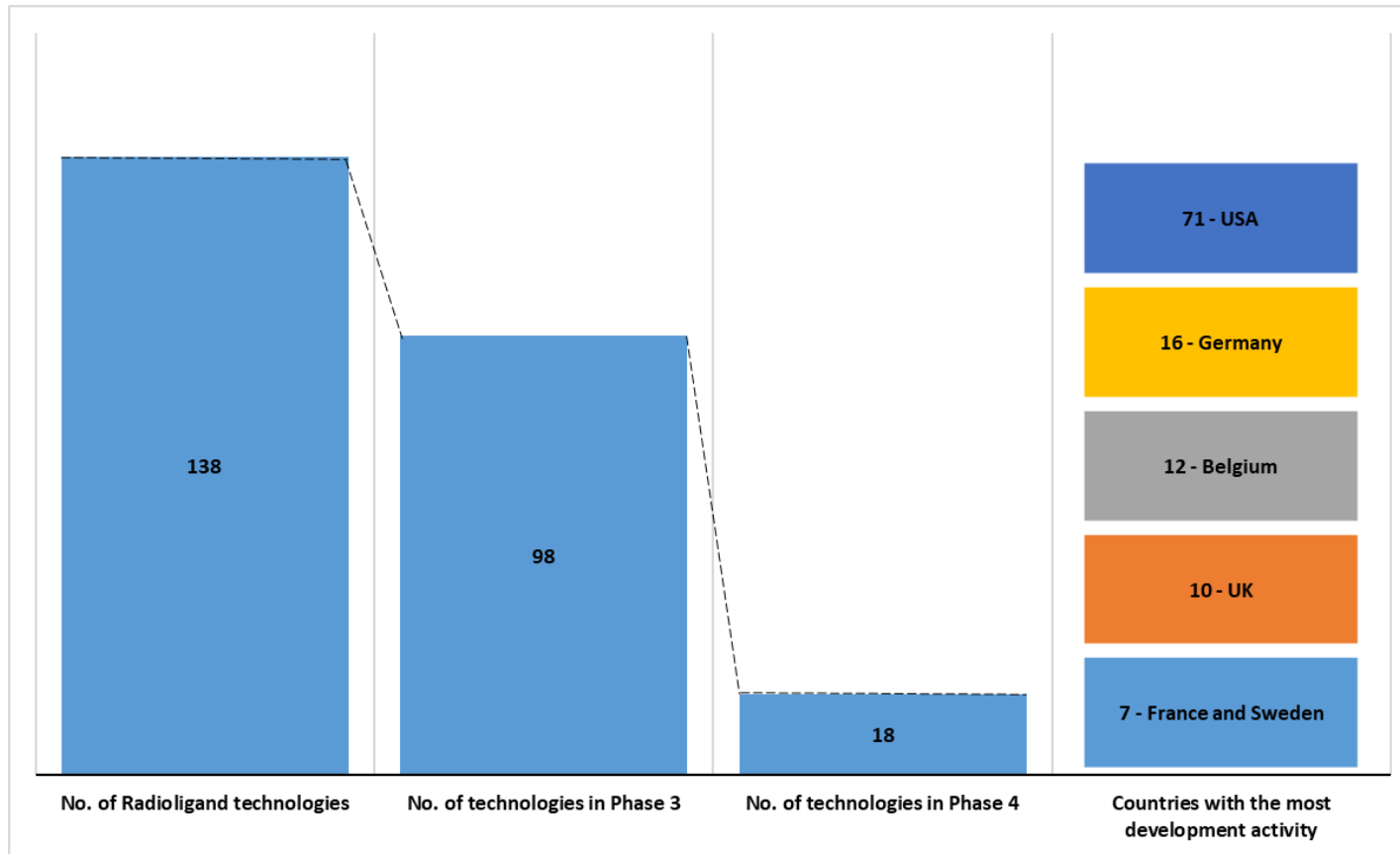
1. This is a rapid technology scan with a limited scope, and results should be interpreted as such
2. IO are not subject matter experts in radioligand technologies
3. The radioligand field is particularly problematic for the variety of search terms used (i.e. lack of standardized terminology)
4. The classification of technologies was complex and at times subjective due to limited or incomplete information available for the technology or complex aspects of the technology or application which require expert knowledge

Development Stage of Radioligand Innovations



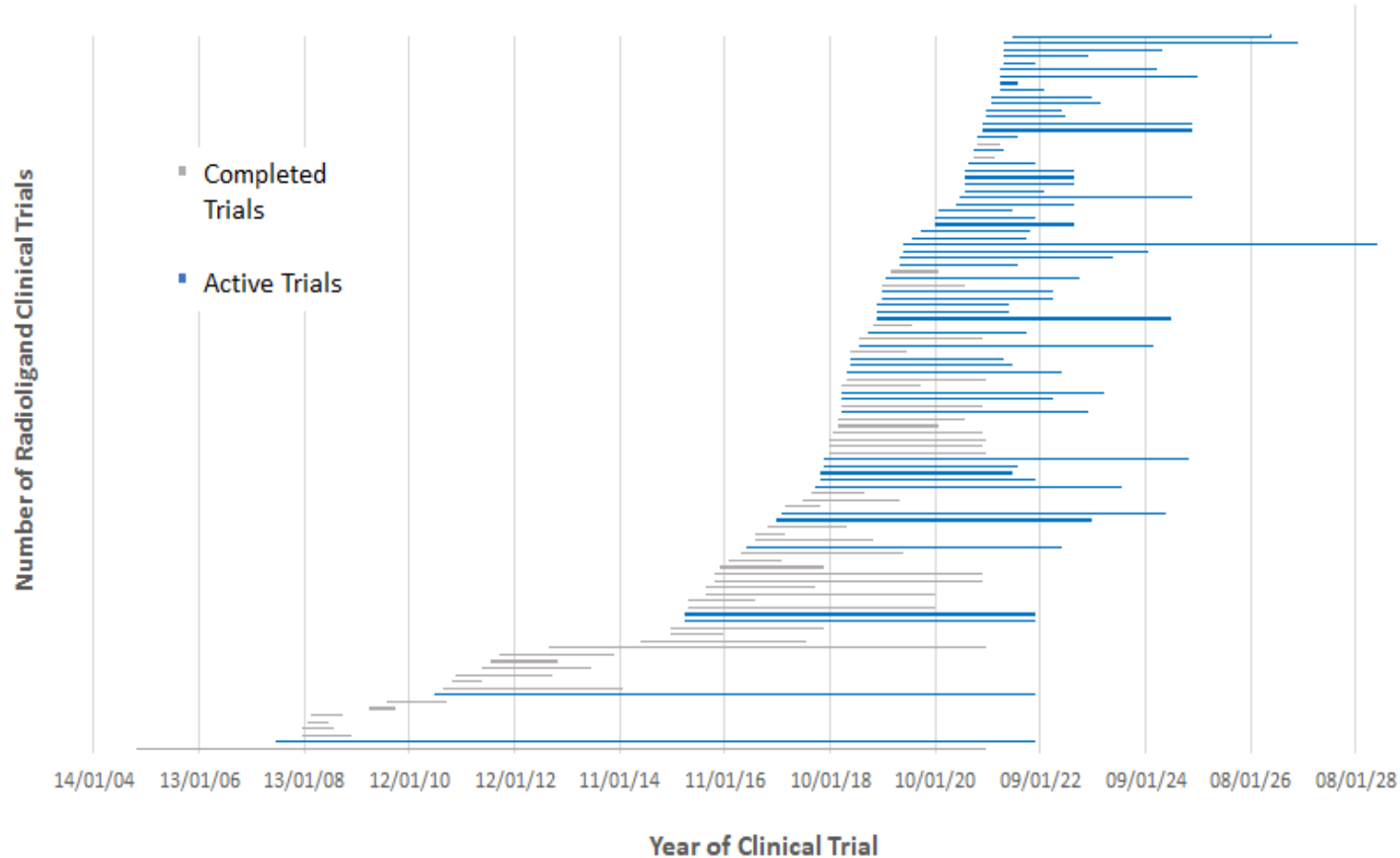
- 3.6% were Phase 1 (i.e. concept)
- 12.4% were Phase 2 (i.e. prototype/ early-stage research including preclinical animal models)
- 71.0% were Phase 3 (i.e. product validated/ demonstrated in relevant environment/ clinical study)
- 13.0% were Phase 4 (i.e. product ready to launch/ regulatory approved)

Key Insights into Radioligand Innovations



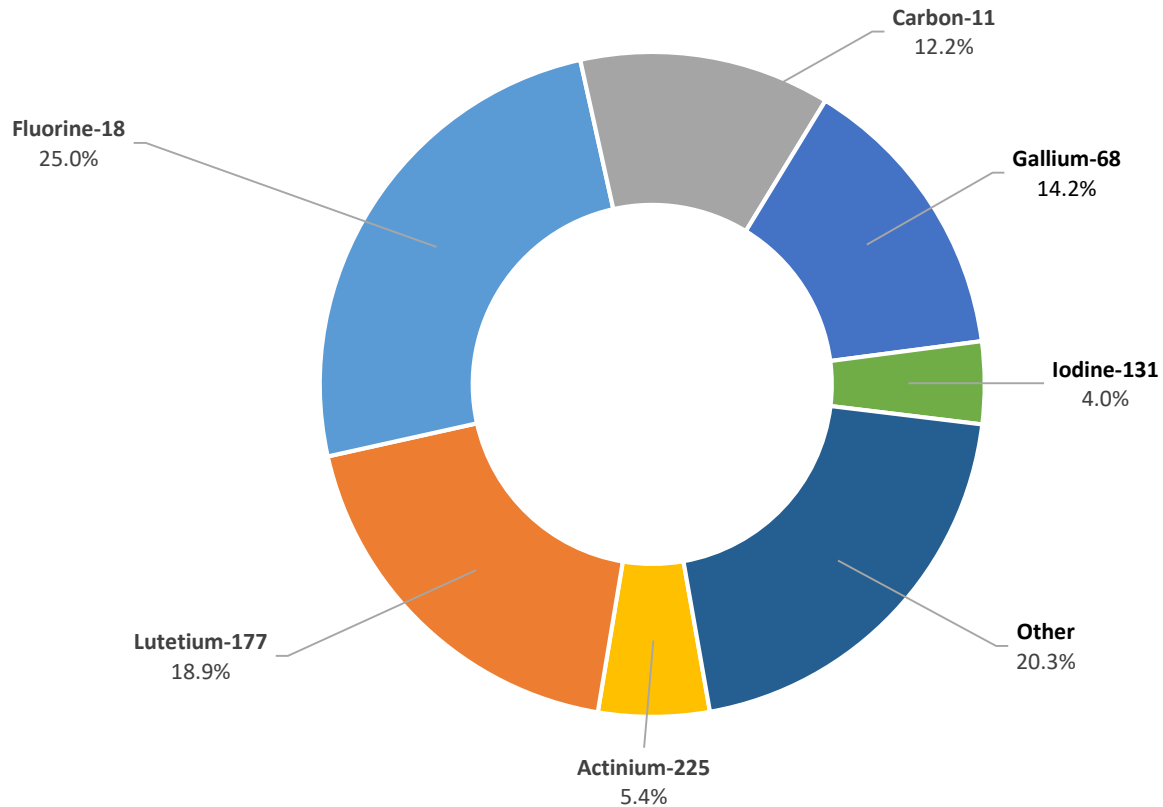
- Pipeline of innovations has grown during the last decades
- Over 130 innovative radioligand therapies were identified from across 20 countries, with development activity largely concentrated in the USA and Europe
- Majority of innovations in phase 3 of development
- Over 80 developers were identified, with the majority categorised as SMEs, followed by large enterprises and academic research institutions
- A large number of developers have expanded their targeted cancer therapy portfolios to identify new targets in cancer and non-cancer conditions

Radioligand Clinical Trial Landscape



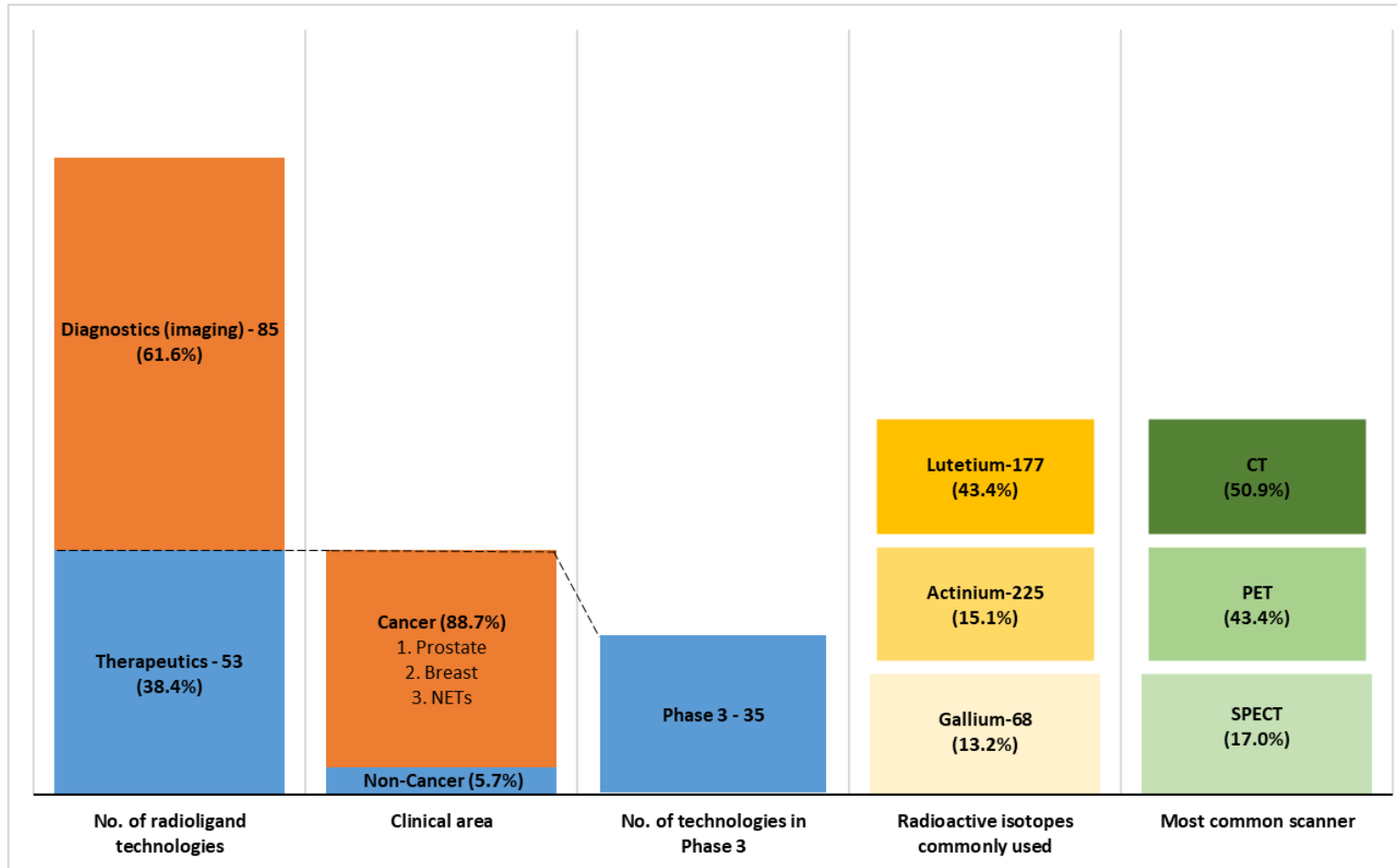
- Significant clinical trial activity in the application and evaluation of radioligand therapies
- High number of academic and commercial led studies (globally), over the last decade
- NIHRIO trial scan retrieved 18,798 results between 1995 – 2021
- Due to the limited time of this project only 267 trials were screened - 109 were considered to meet the scope of this project

Radioligand Isotopes



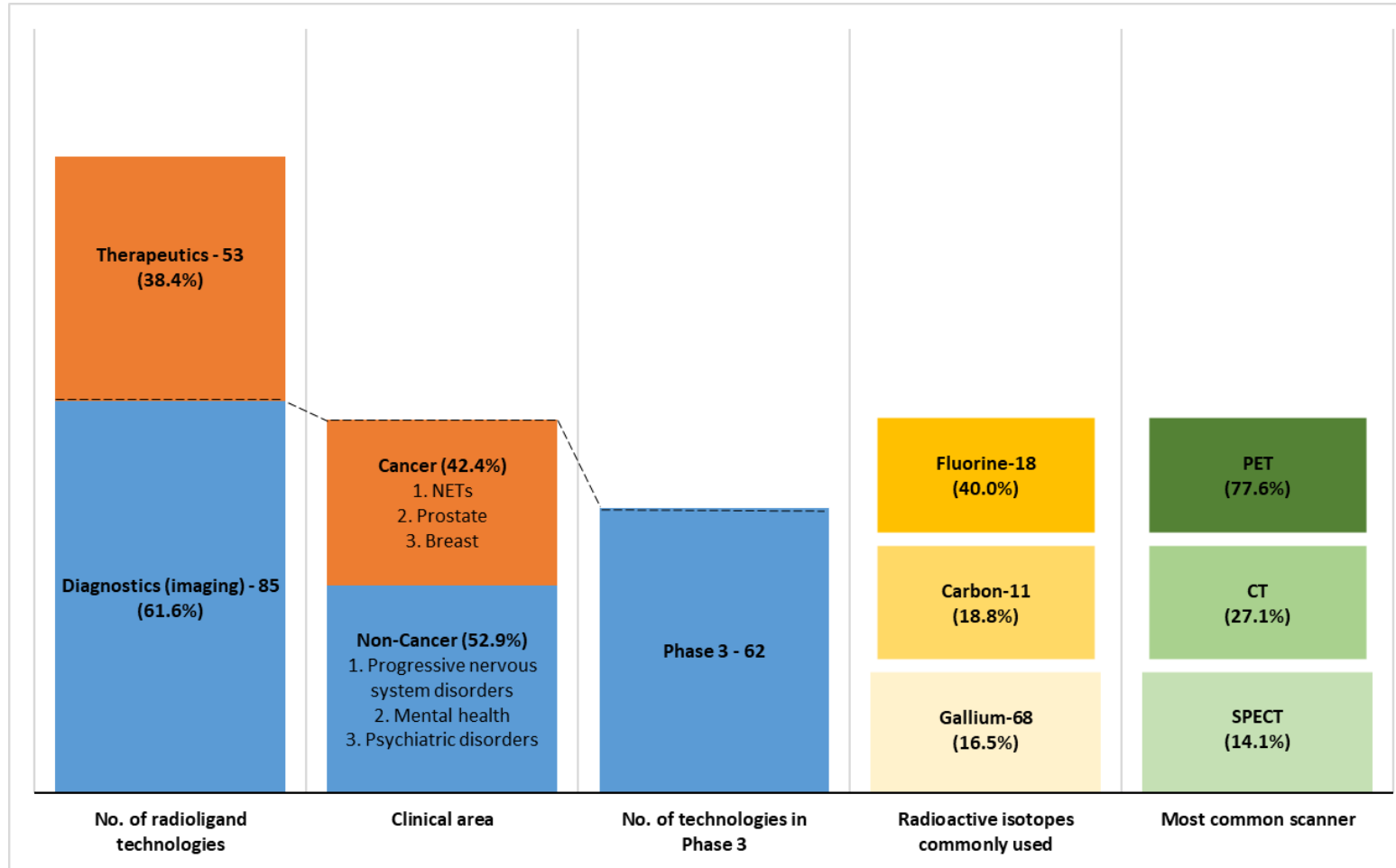
- Different radioactive isotopes have different properties; some can be used for imaging, others for therapeutic purposes and some have applications for both
- Isotopes most commonly used were Fluorine-18 (25.0%), Lutetium-177 (18.9%) and Gallium-68 (14.2%)
- The latest insights (business and research) into radioactive isotopes reveal the following key topics:
 - Supply of radioactive isotopes for medical use
 - Current developments in nuclear medicine/radioactive isotopes include creating new and cost-effective ways to produce large amounts of medically useful radioactive isotopes
 - Evaluation of new indications for existing radioactive isotopes/radiopharmaceuticals
 - Improving the safety of radioactive isotopes
 - Radioactive waste management

Key Insights into Radioligand Application - Therapeutic (Treatment)



- Majority of radioligand technologies in development for therapeutic purposes are targeted cancer therapies (88.7%)
- Radioligand cancer therapies are primarily developed for prostate and breast
- The newest applications of radioligands focus on neuroendocrine tumours (NETs) and melanoma skin cancer
- Novel therapies for non-cancer conditions are in development for mental health conditions and COVID-19/ viral pneumonia
- Radioligands are in development for a variety of imaging applications: positron-emission tomography (PET), computed tomography (CT) and single-photon emission computed tomography (SPECT)

Key Insights into Radioligand Application – Diagnostic (Imaging)



- A higher proportion of radioligand technologies in development for diagnostic purposes are in the pipeline for non-cancer conditions (52.9%), compared to cancer (42.4%)
- Novel diagnostic applications for non-cancer conditions include mental health conditions and progressive neurological disorders such as Alzheimer's Disease, Parkinson's Disease, Huntington's Disease and Dementia
- Radioligand diagnostic technologies targeted at cancer are primarily developed for prostate, breast and NETs
- The majority of research and development is concentrated on suitable PET radioligand technologies

Summary of Key Messages

Our rapid technology scan of Radioligand therapies found:

- Radioligand therapy is a new but fast-growing field with a small number of commercialized products (i.e. regulatory approved/ ready to market), with many more at the later stage of development (phase 3)
- Innovations in the pipeline will target a much larger range of cancers and other diseases
- Major players in the global radioligand market: Novartis, Isotopen Technologien München, POINT Biopharma and AstraZeneca. Other types of developers include SME's, large enterprises and academic institutions, based across North America (projected market lead) and Europe
- Radioligand market is expected to experience massive growth in the period 2021-2027 driven by increase in cancer prevalence, expansion of the scope of radioligand therapy, government funding, strategic acquisitions and collaborations by major players
- Evidence appears to show that radioligand therapies have the potential to increase quality of life and survival for people with rare, progressive and metastatic cancers that are resistant to other treatments
- Barriers to the implementation of radioligand therapies include issues with supply of radioactive isotopes, lack of specialist professionals, hospital capacity and infrastructure needed to deliver this therapy, such as PET scanners

Conclusion & Implications

- IO have identified immediately relevant data on the pipeline of radioligand therapies, to allow decision-makers and healthcare organisations to evaluate the potential impact of these technologies against their priorities and anticipate some of the consequences for the care pathway
- There is evidence that a growing number of radioligand therapies are in the pipeline, thus there may be value in considering how this will impact commercial negotiations for existing and future technologies in the NHS
- Given the growth in demand for targeted cancer therapies with higher efficacy, radioligand therapies are likely to become an increasingly important part of cancer care
- The emerging number of radioligand innovations also presents an opportunity for the stakeholders to influence the development of early, non-commercialised technologies (cancer and non-cancer) within the UK