

COMMENT OPEN



Introduction to the National Cancer Imaging Translational Accelerator (NCITA): a UK-wide infrastructure for multicentre clinical translation of cancer imaging biomarkers

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The National Cancer Imaging Translational Accelerator (NCITA) is creating a UK national coordinated infrastructure for accelerated translation of imaging biomarkers for clinical use. Through the development of standardised protocols, data integration tools and ongoing training programmes, NCITA provides a unique scalable infrastructure for imaging biomarker qualification using multicentre clinical studies.

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Imaging biomarkers have potential to provide objective, minimally invasive tools for the diagnosis and therapeutic management of tumours, including quantitative assessment of tissue microstructure, metabolism and function. However, clinical imaging within healthcare systems remains largely limited to assessment of anatomical changes in tumour size, with a few notable exceptions such as assessment of tumour metabolism using positron emission tomography (PET) with 2-deoxy-2-[fluorine-18]fluoro-D-glucose integrated with computed tomography ([¹⁸F]FDG PET-CT) [1, 2]. This gap between translatable imaging biomarker research and clinical application reflects the challenges in crossing two key 'translational gaps' [3, 4]; namely translation of promising candidates into fully validated and standardised products and the provision of robust evidence to support their implementation and adoption into clinical practice [5]. For complex multicentre imaging biomarker studies, differences in imaging sequences for different scanners, field strengths and vendors and inter- and intra-observer variability in image acquisition and analysis pose significant challenges for standardisation. Here, we outline a new coordinated infrastructure designed to accelerate the clinical translation of robust and reproducible imaging biomarkers to transform cancer diagnosis and improve healthcare outcomes for patients.

The National Cancer Imaging Translational Accelerator (NCITA) is a clinical imaging research consortium, which is creating the necessary integrated infrastructure to accelerate robust qualification of cancer imaging biomarkers for clinical use, as proposed in the Imaging Biomarker Roadmap for Cancer Studies [5]. Established in 2019, through Cancer Research UK (CRUK) Accelerator award funding, NCITA builds on previous Cancer Imaging Centres

Initiatives (2008–2018), funded by CRUK and the Engineering and Physical Sciences Research Council (EPSRC), which were pivotal in driving innovation in biomarker research using novel imaging techniques [6–11]. NCITA brings together nine UK centres of excellence for medical imaging, namely, University College London, The University of Manchester, University of Oxford, King's College London, The Institute of Cancer Research (ICR), Imperial College London, University of Cambridge, University of Glasgow and Newcastle University (Supplementary 1). This multi-institutional collaborative network includes medical imaging experts, clinical oncologists, physicists and research scientists who are developing standardised imaging biomarker qualification pipelines to accelerate the development of qualified imaging biomarkers using multicentre studies.

The NCITA infrastructure includes three cross-institutional units (imaging clinical trials unit (CTU), quality assurance/quality control (QA/QC) and repository units) and three activity groups (engagement, training and contracts management), which together with the Governance Group, work in synergy to facilitate cross-sector translational imaging biomarker research. The goals of NCITA are to establish standardised protocols and locked-down quality-assured processes for imaging biomarker qualification and a federated research data repository for secure data storage and sharing between study sites. The repository incorporates automated QA and post-hoc computational image analysis using containerised workflows, novel machine learning and artificial intelligence (AI) tools (Fig. 1). To improve study efficiencies, NCITA is developing unified contracts, policies and standard operating procedures that transcend individual institutions. Through engagement with key imaging stakeholders, NCITA will develop

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NCITA's data sharing solutions are based on the FAIR principles [13], that data are findable, accessible, interoperable and reusable. For NCITA's adopted studies, streamlined data access procedures will enable data sharing, including an approach to the relevant Ethics and Trial Steering Committees. For non-NCITA sites, data access will involve an application process and will be regulated by audited procedures. Open-access data resources will also be developed for the imaging research community worldwide.

The Repository and QA/QC Units are developing quality-assured pipelines for imaging biomarker qualification from source image data. Recent work includes implementation of the VERDICT technique [14], radiomics pipelines in line with International Biomarker Standardisation Initiative guidelines [15] and a plugin to enable automatic assessment of incoming imaging datasets to determine compliance with study protocols. The Repository Unit is also developing AI-assisted image annotation for radiologists, linking of curated imaging datasets to publications and generation of datasets for AI development. The Repository Unit is also engaged in the release lifecycle of XNAT and is the integrator of the Open Health Imaging Foundation (OHIF) viewer into XNAT [16], which provides a flexible framework for building web-based imaging applications to support clinical imaging research.

A key goal for NCITA is to generate consensus on how the imaging biomarker development pathway can be improved to achieve more efficient translation of quality-assured imaging biomarkers into clinical practice. The NCITA Engagement Group are engaging with key imaging stakeholders, to facilitate the establishment of a consensus group to agree and publish recommendations for accelerating robust qualification and adoption of imaging biomarkers for clinical use. The Engagement Group also facilitates clinical researchers from academia and industry to access the NCITA infrastructure and works closely with CRUK's Commercial Partnerships team to ensure translational support for new discoveries arising from exemplar projects and other projects supported by CRUK. Other engagement activities include dissemination of news, events and information through the NCITA website (<https://www.ncita.org.uk>), social media accounts (NCITA Imaging (@imaging_cancer)|Twitter and LinkedIn), press releases and publications.

During the 5-year CRUK Accelerator Award, NCITA will have established the necessary integrated infrastructure to facilitate accelerated translation of imaging biomarkers for clinical application. To ensure continued growth and sustainability, NCITA will link with NHS initiatives including the NIHR Biomedical Research Council/Clinical Research Network and NIHR Imaging Group, as well as funding bodies, charities and industrial partnerships. The sustainability of NCITA will have significant benefits in streamlining future clinical imaging studies and providing ongoing training of a new generation of highly skilled medical imaging researchers to accelerate personalised and precision medicine for cancer care.

DATA AVAILABILITY

Not applicable.

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AUTHOR CONTRIBUTIONS

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ETHICS APPROVAL AND CONSENT TO PARTICIPATE

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CONSENT FOR PUBLICATION

Not applicable.

COMPETING INTERESTS

The authors declare no competing interests.

ADDITIONAL INFORMATION

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