

Emerging approaches for optimizing molecular radiotherapy

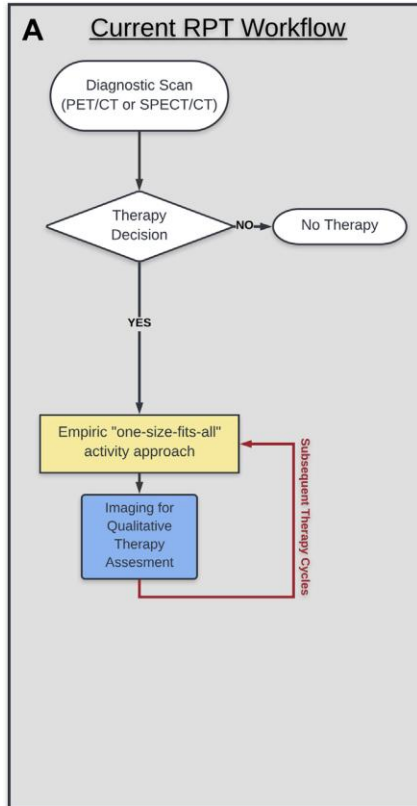
Julia Brosch-Lenz, PhD

Institute of Nuclear Medicine

Randomized
Clinical Trials

(Improved)
quantitative
imaging

Faster, greater, better?

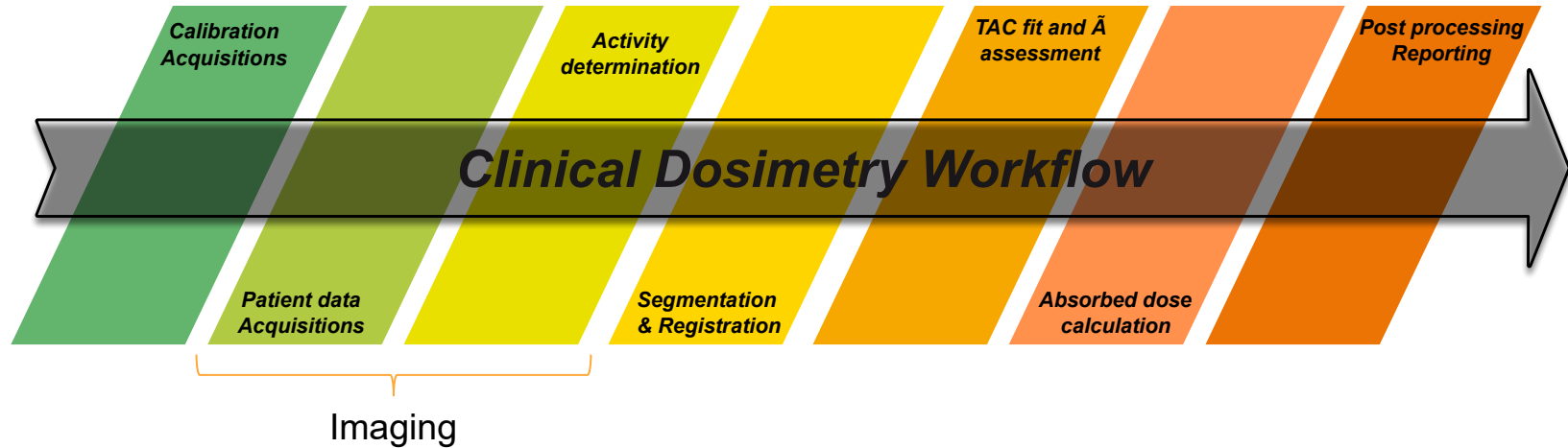


Routine
Dosimetry

Large patient
cohorts

Radiobiological
models

Personal view and selection of the speaker 😊



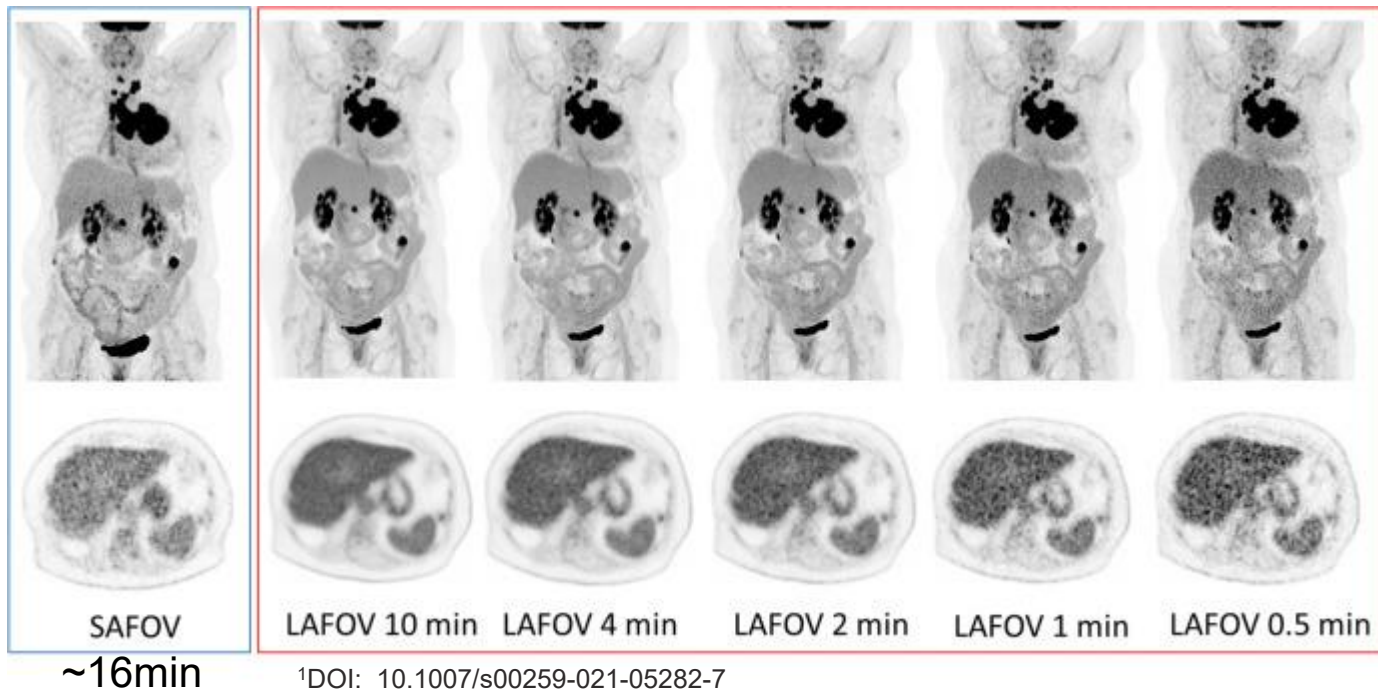


Imaging

EFOMP

PET

- LAFOV: <2min vs. SA ~16min, Rominger et al.¹



¹DOI: 10.1007/s00259-021-05282-7



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RADIONUCLIDE INTERNAL DOSIMETRY

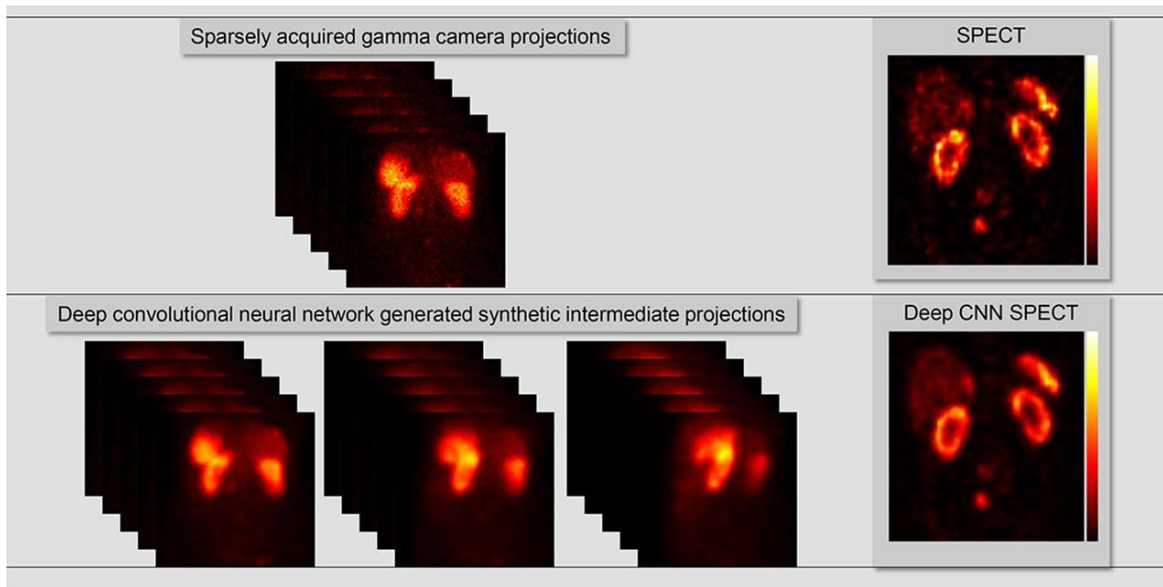


Imaging

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SPECT

- AI for synthetic intermediate projections, Rydén et al.¹
- 120 vs. 30 + 90SIP $\rightarrow$ $\frac{1}{4}$ of the time!

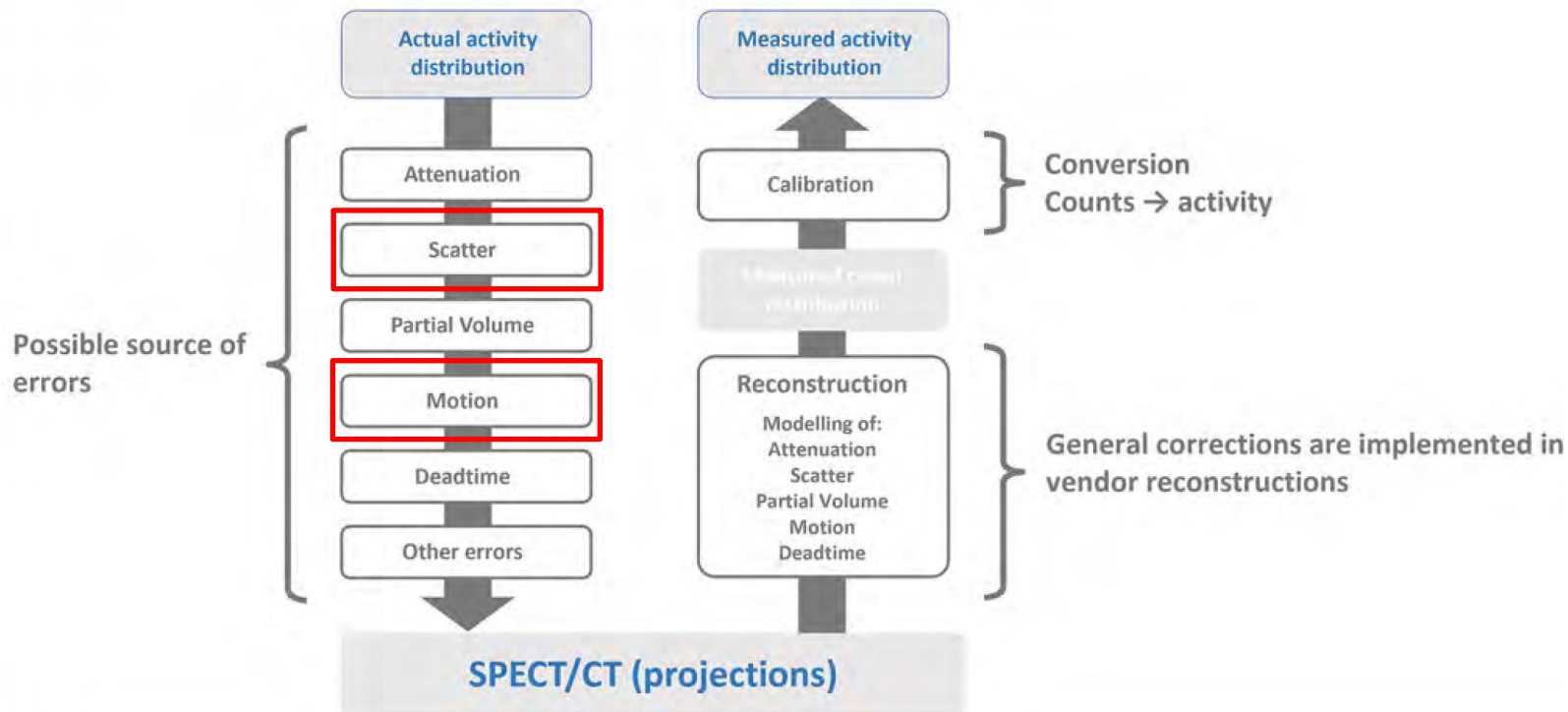


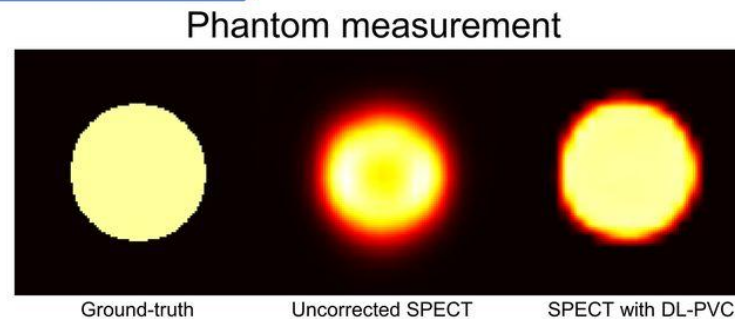
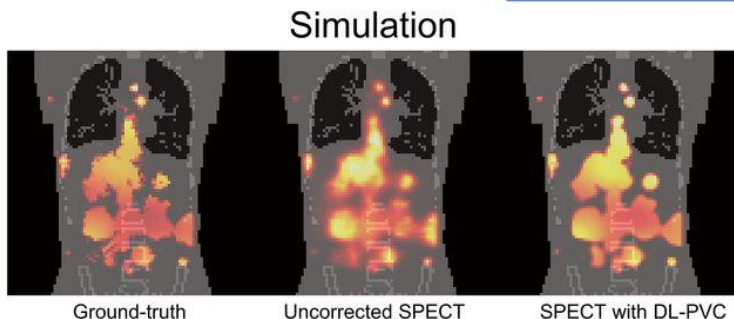
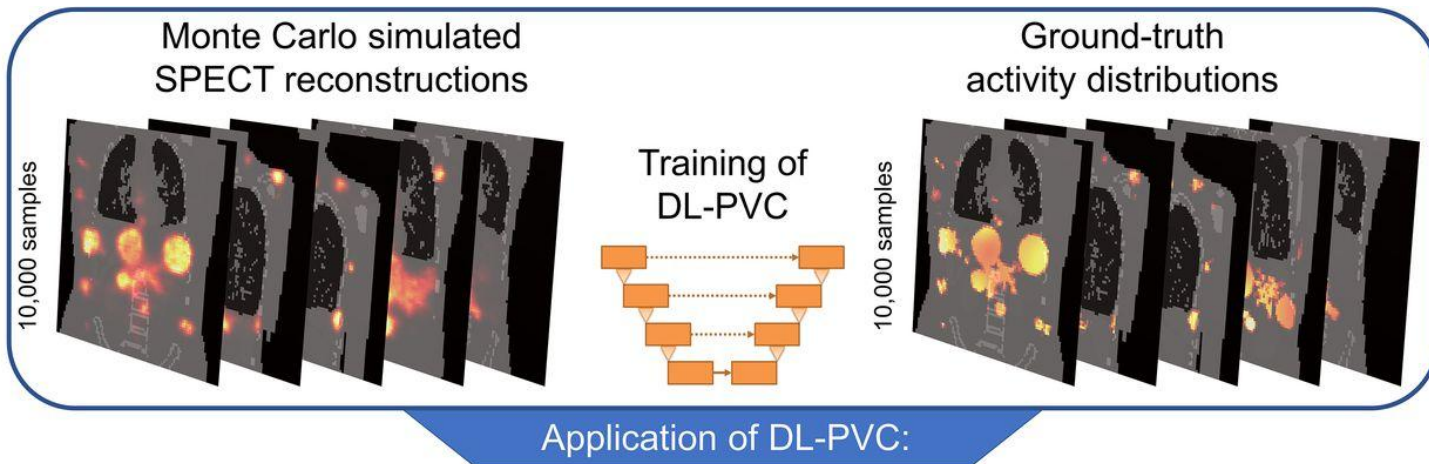
¹DOI: <https://doi.org/10.2967/jnumed.120.245548>

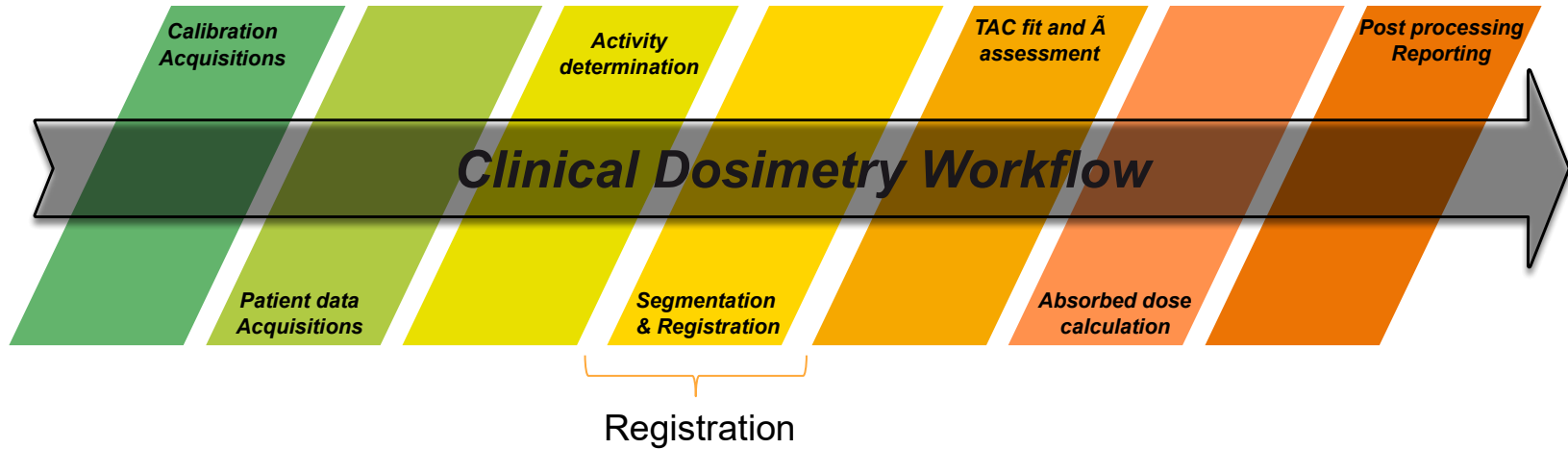


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Imaging









Challenge

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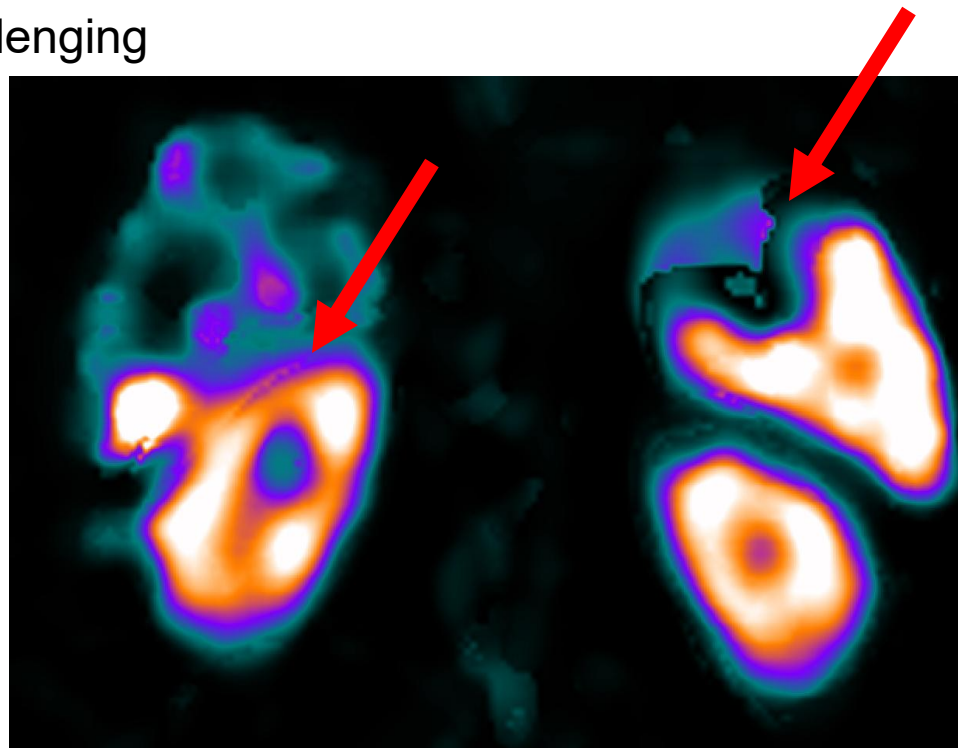
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Voxel-wise TAC assessment:

- Voxel by voxel co-registration is challenging
- Motion issues (inter- and intra-scan)

→ **Artefacts!**

→ **Value of voxelized dosimetry?**





Good news!

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- Dose-effect relationship publications are thriving!

Journal of Nuclear Medicine, published on December 21, 2023 as doi:10.2967/jnumed.123.26

European Journal of Nuclear Medicine and Molecular Imaging
<https://doi.org/10.1007/s00259-024-06863-y>

ORIGINAL ARTICLE

Prediction of ^{177}Lu -DOTATATE PRRT Outcome

Journal of Nuclear Medicine, published on April 18, 2024 as doi:10.2967/jnumed.123.267023

Journal of Nuclear Medicine, published on April 18, 2024 as doi:10.2967/jnumed.123.267023

Journal of Nuclear Medicine, published on August 7, 2025 as doi:10.2967/jnumed.125.270170

Absorbed Dose–Response Relationship in Patients with

Journal of Nuclear Medicine, published on April 24, 2025 as doi:10.2967/jnumed.125.270170

Lesion Absorbed Dose–Response Relationship in Patients with Metastatic Castration-Resistant Prostate Cancer Undergoing

Multicycle Dosimetric Behavior and Dose–Response Relationship in Patients with Metastatic Castration-Resistant Prostate Cancer Undergoing

in [^{177}Lu]Lu-DOTATATE Peptide Receptor

Radionuclide Therapy

Milan Grkovski^{*1}, Simone S. Krebs^{*2,3}, Joseph A. O'Donoghue¹, Jonathan Kuten², Audrey Mauguen⁴, Parnian Shobeiri², Daniel Lafontaine¹, Maria Thor¹, Finn Augensen¹, Josef J. Fox², Neeta Pandit-Taskar^{2,5}, Mark P. Dunphy², Lisa Bodei², John L. Humm¹, and Heiko Schöder²

Gunjan Kayal¹, Molly E. Roseland¹, Chang Wang², Kellen Fitzpatrick¹, David M. Berman¹, and Yuni K. Dewaraja¹

¹Department of Medical Physics, Memorial Sloan Kettering Cancer Center, New York, New York; ²Molecular Imaging and Therapy Service, Department of Radiology, Memorial Sloan Kettering Cancer Center, New York, New York; ³Department of Nuclear Medicine, Division of Diagnostic Imaging, University of Texas M.D. Anderson Cancer Center, Houston, Texas; ⁴Department of Epidemiology and Biostatistics, Memorial Sloan Kettering Cancer Center, New York, New York; and ⁵Nuclear Medicine Division, Department of Radiology, University of Pittsburgh Medical Center, Pittsburgh, Pennsylvania



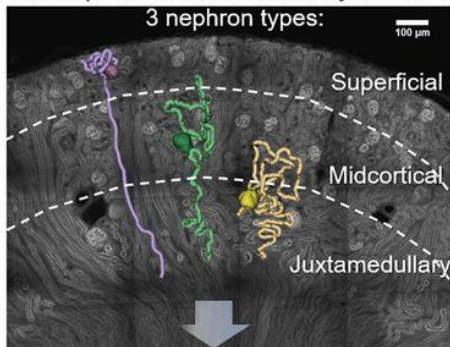
Preclinical methodological work



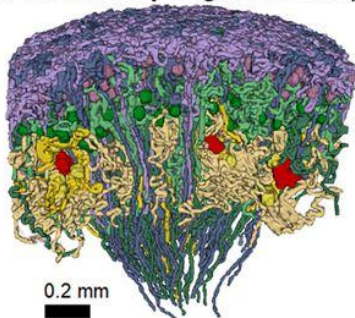
Micro-models

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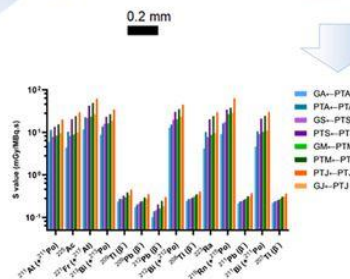
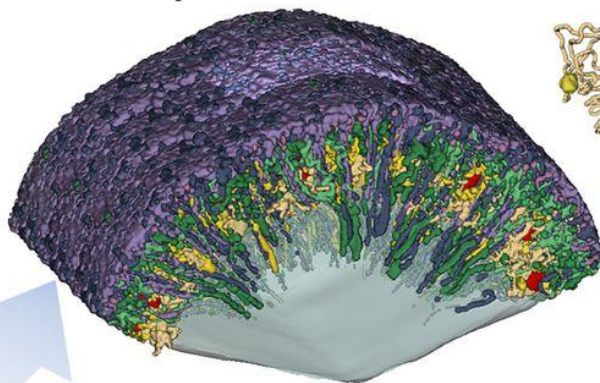
3D multiphoton mouse kidney tissue data



417 individually segmented nephrons



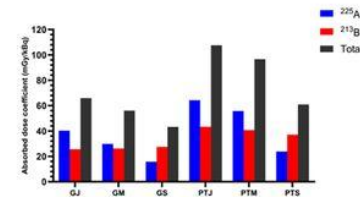
Multi-nephron computational model



S value database on nephron substructure level for α - and β -emitting radionuclides

+ NTCP models!

Detailed nephron level dosimetry to support nephrotoxicity studies



+ Biodistribution data



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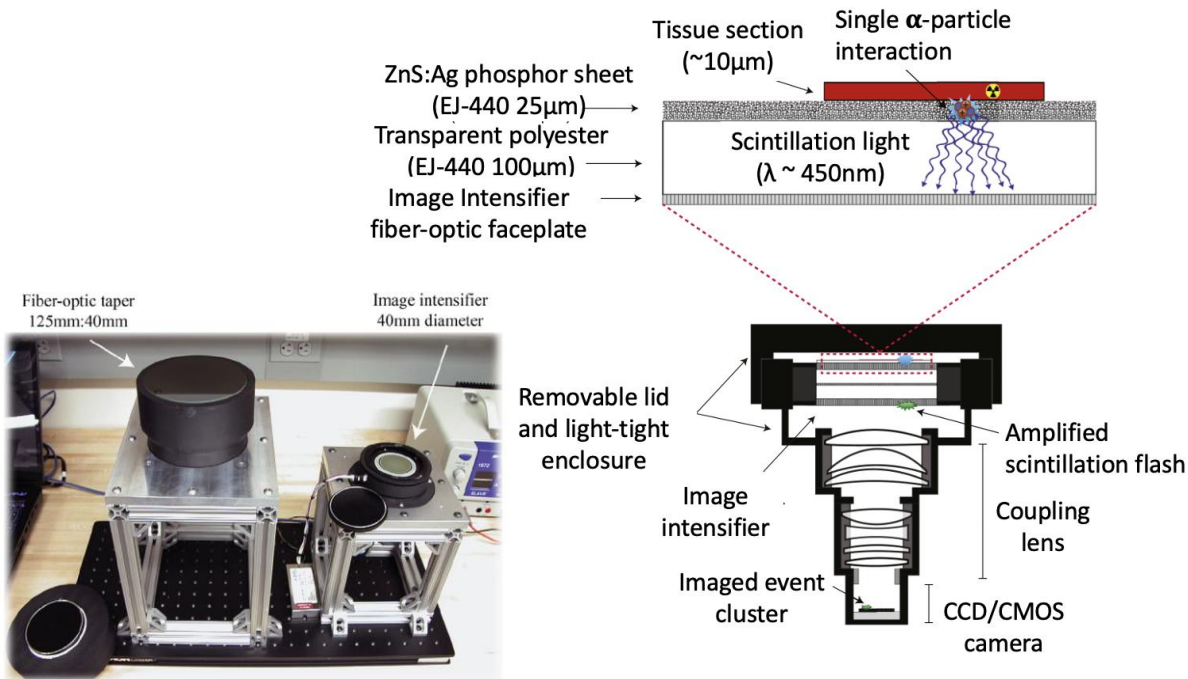
Alpha imaging

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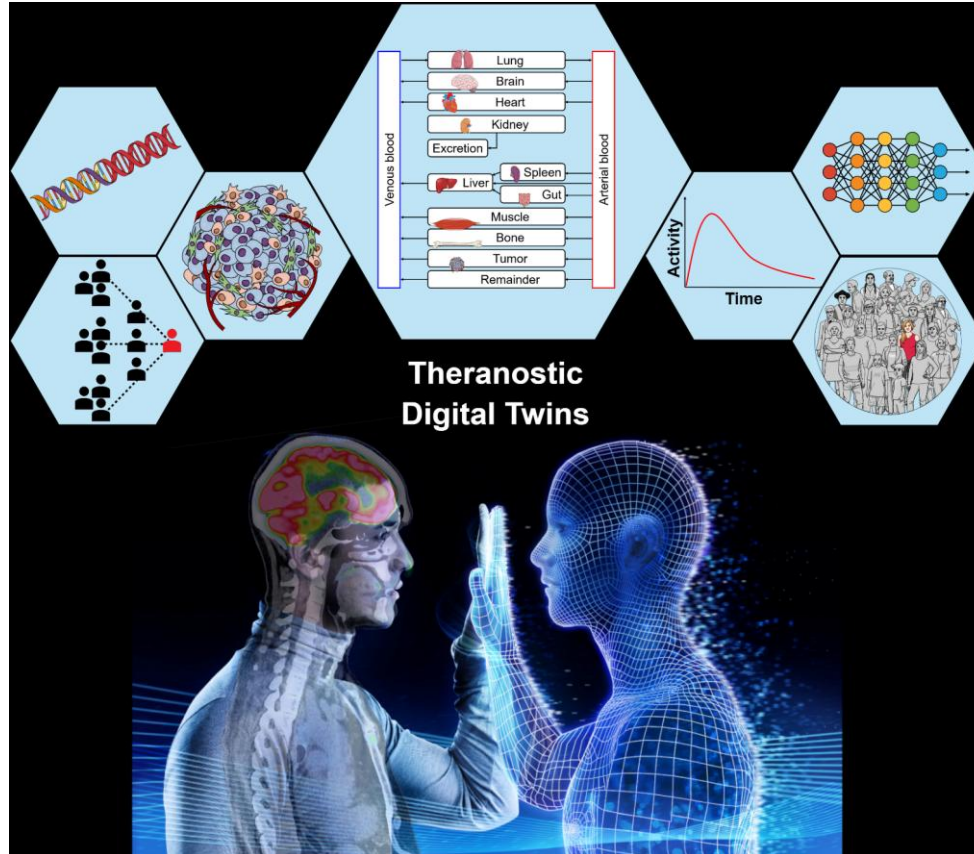
- iQID: ionizing-radiation quantum imaging detector

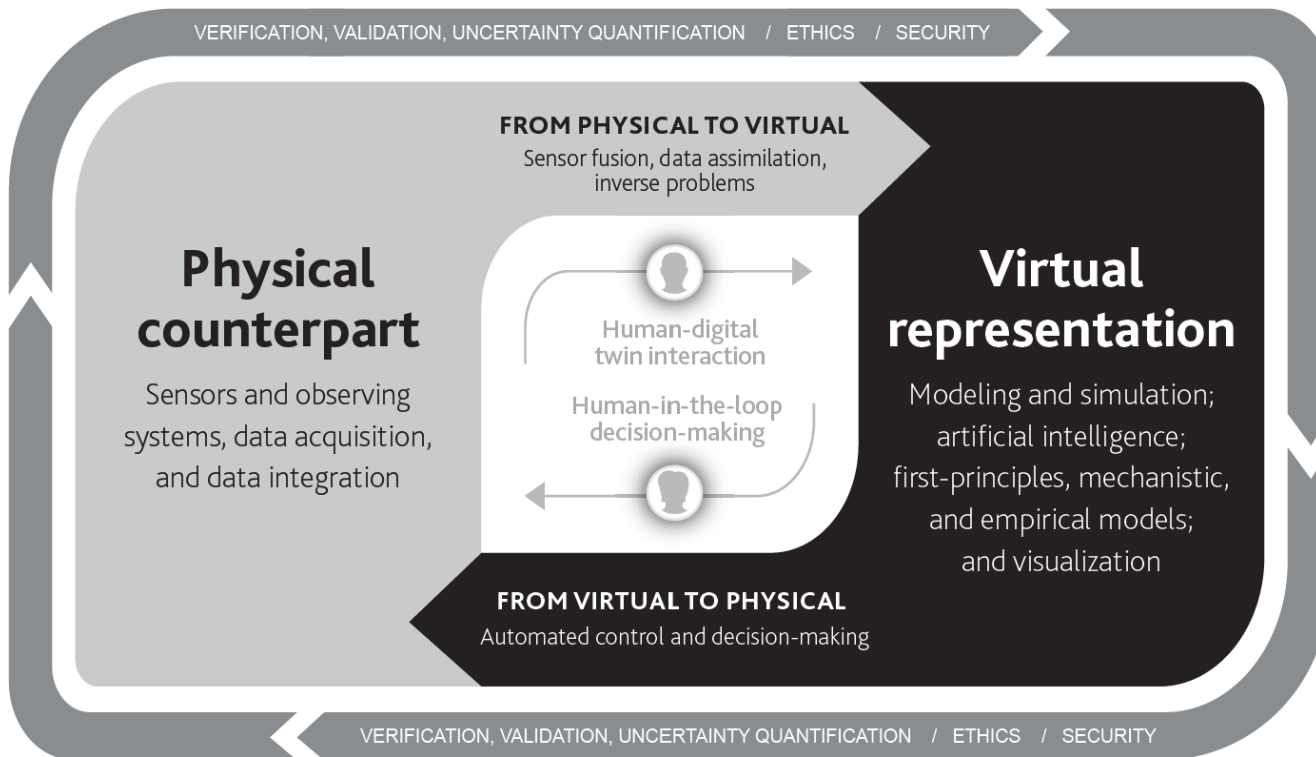




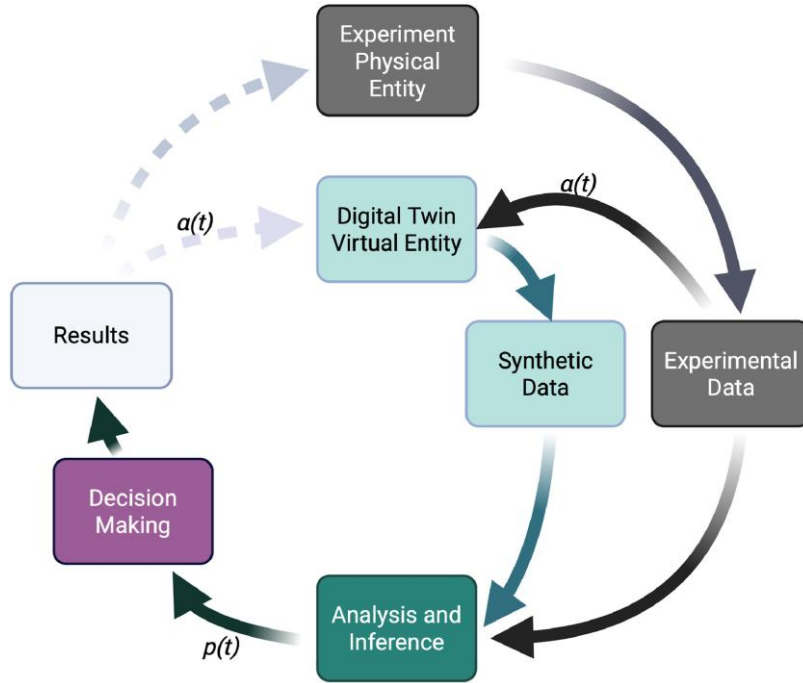
What else??

Theranostic Digital Twins

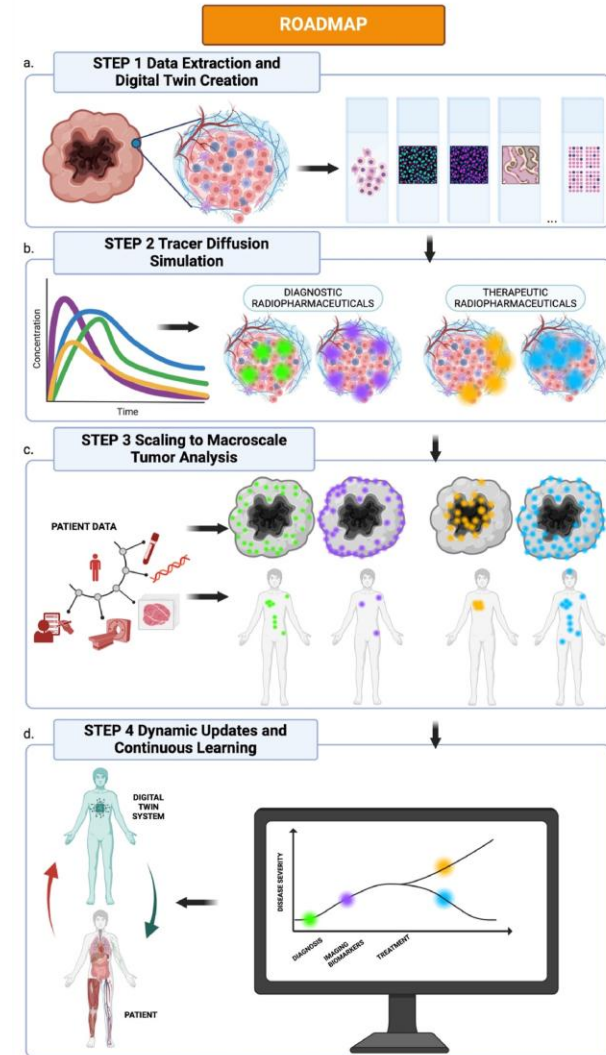




AI-guided Digital Twin

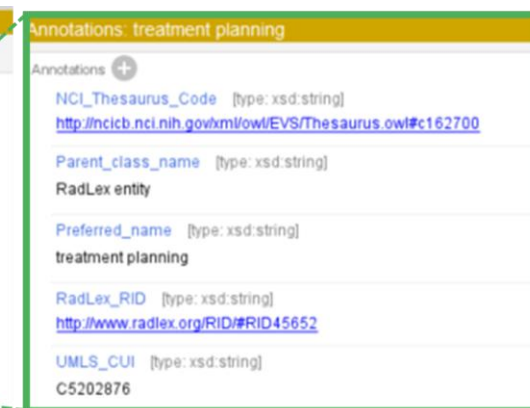
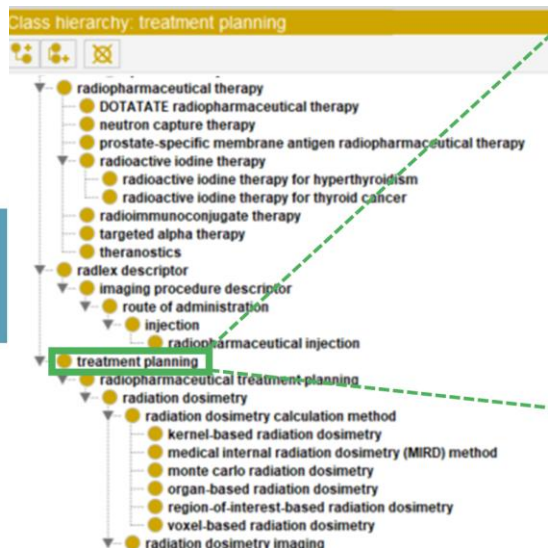
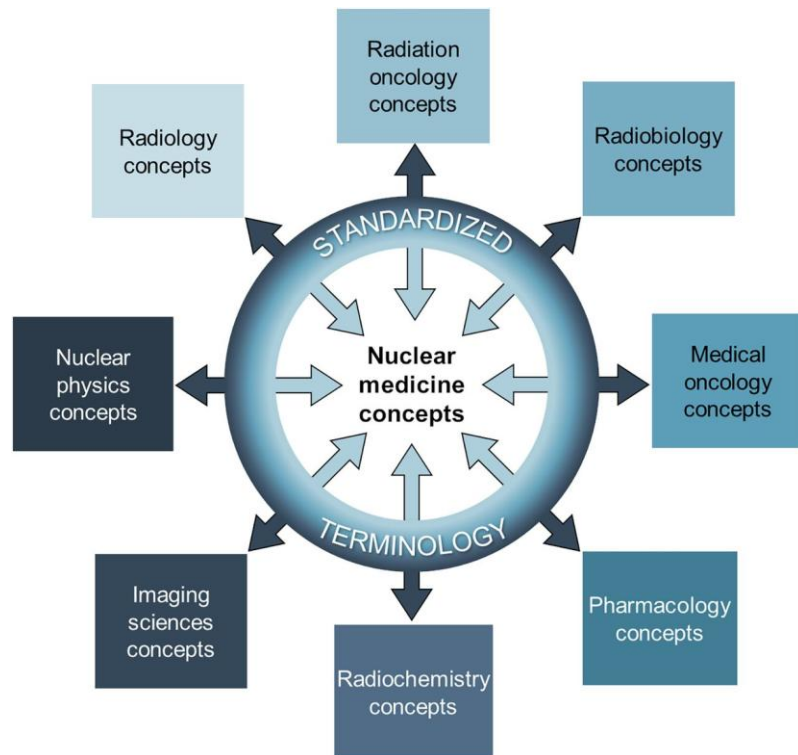


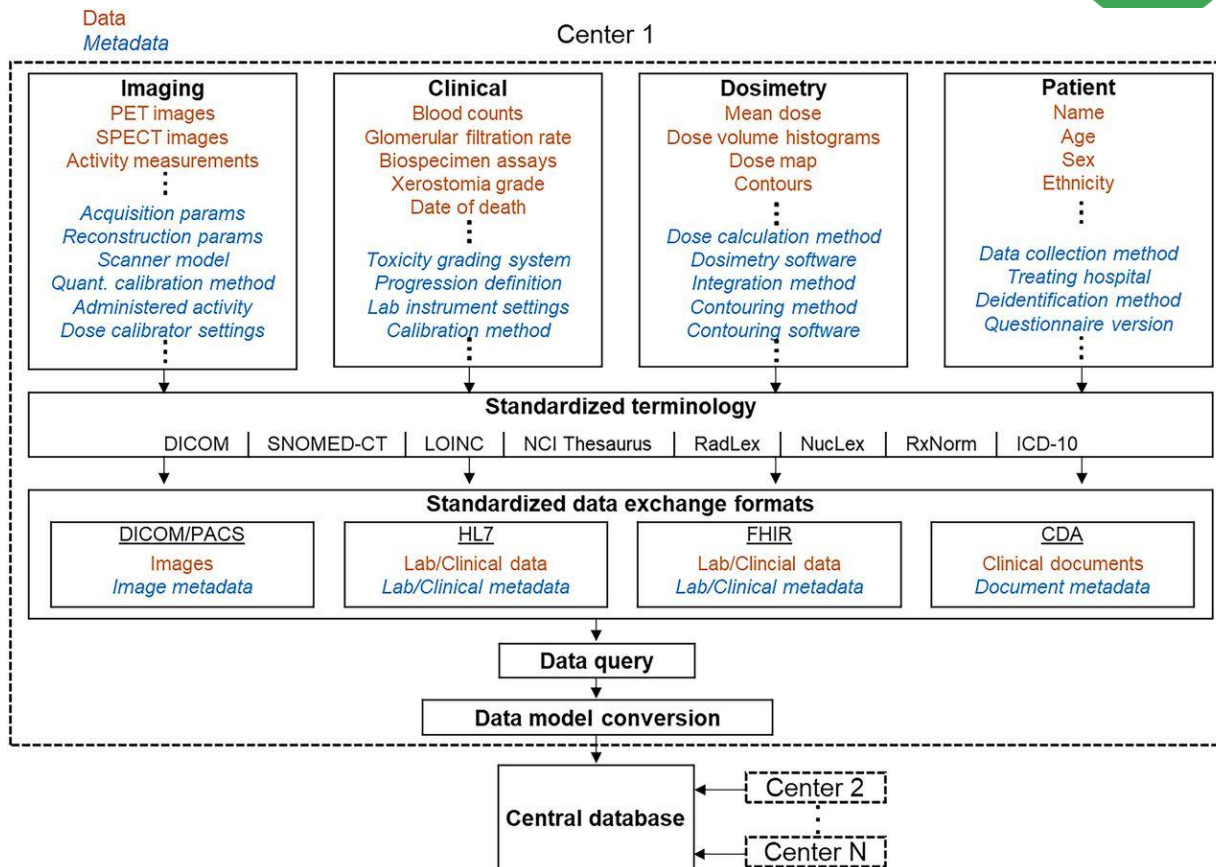
<https://doi.org/10.1016/j.eanmj.2025.100007>



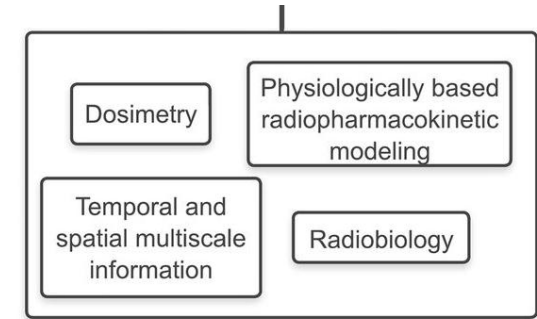
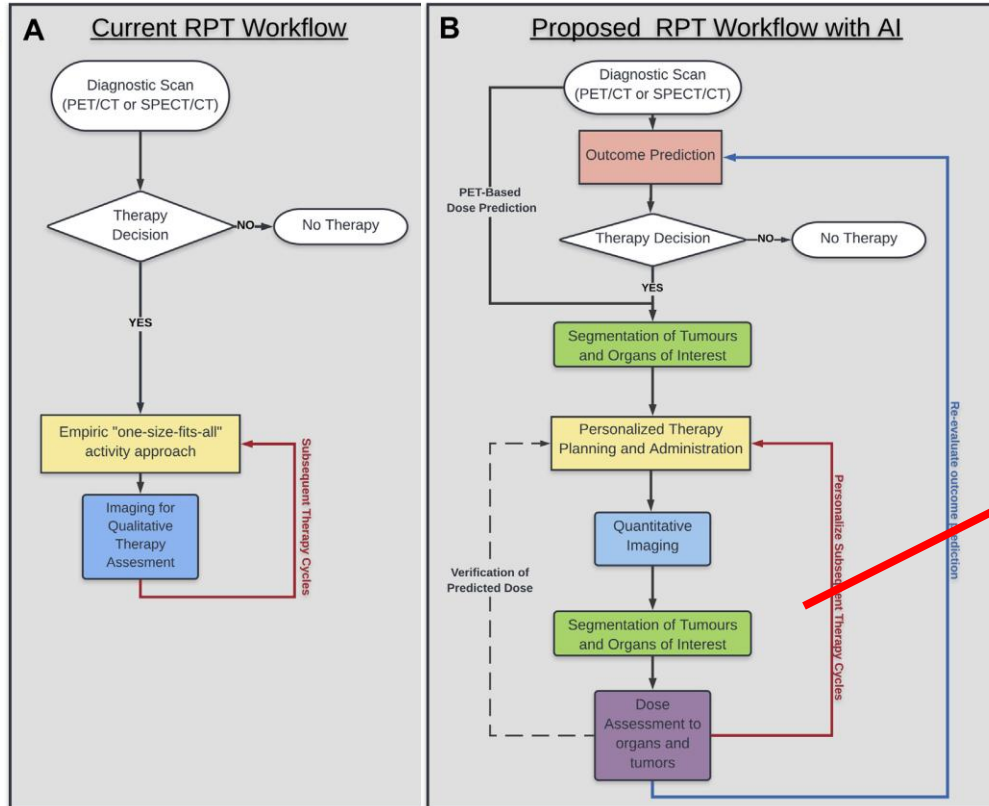
How to get there?

Standardization





The future?



DOI: 10.1016/j.cpet.2021.06.002

DOI: <https://doi.org/10.2967/jnumed.124.267927>



Outlook – Initiatives (to name a few)



EFOMP

RPT-TEC:

- DOI: 10.1200/JCO.23.01241
- <https://mirdsoft.org/community/rpt-tec-data-collection-template>

RaPTR (Radiopharmaceutical Therapy Registry):

- <https://snmmi.org/Web/Clinical-Practice/RaPTR/Default.aspx>

Joint AAPM-EANM-SNMMI-EFOMP “DICOM QSPECT MRT” working group:

- <https://www.efomp.org/index.php?r=news/view&id=353>

Thank you for your attention!

Questions?



University of Michigan
exemplary Lu-177
DOTATATE patients

Acknowledgements:

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Adam Kesner
Lidia Strigari
Tyler Bradshaw



Become a SIG_FRID
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