AI in Medical Imaging and Decision Support: The Perspective of the RSNA Quantitative Imaging Biomarkers Alliance (QIBA®)

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Quantitative Imaging Biomarker Challenges

Diagnostic Imaging Equipment ≠ Measurement Device

- Measurement Device:
  - Specific measurand(s) with known bias and variance (confidence intervals)
  - Specific requirements for reproducible quantitative results
- Diagnostic Imaging Equipment:
  - Historically: best image quality in shortest time (*qualitative*)
  - No specific requirements for reproducible *quantitative* results (with few exceptions)

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Quantitative Imaging Biomarker Challenges

General QIB technical challenges:

- Lack of detailed assessment of sources of bias and variance
- Lack of standards (acquisition and analysis)
- Highly variable quality control procedures
  - QC programs / phantoms, if any, typically not specific for *quantitative* imaging
- Little support (historically) from imaging equipment vendors
  - No documented competitive advantage of QIB (regulatory or payer)

All lead to varying measurement results across vendors, centers, and/or time

→ Reduces the value as input into AI algorithms

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Quantitative Imaging Biomarkers Alliance

- QIBA Mission
  - Improve the value and practicality of *quantitative imaging biomarkers* by reducing variability across devices, sites, patients, and time.
  - "***Industrialize*** imaging biomarkers"
  - *Make statistically strong statements about bias, repeatability, and reproducibility of estimates for individual QIBs*

    → *Improve QIB value as input for AI algorithms*

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QIBA Metrology Working Group

Initial efforts focused on estimation of individual QIBs

- Robust statistical framework for:
  - Development of cross-sectional and longitudinal claims
  - Conformance assessment with profile specifications
  - Study design for clinical trials using QI biomarkers

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QIBA Metrology Working Group

Many clinical scenarios involve multiple QIBs

- Multiparametric MRI in prostate cancer involving:
  - T2-weighted MRI
  - diffusion weighted MRI
  - dynamic contrast-enhanced MRI
- These multiparametric QIBs present new issues
  - ➢ *How do we make statistically strong statements about bias, repeatability, and reproducibility of estimates for multiparametric QIBs*
  - ➢ *What is our confidence in the output of AI algorithms?*

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