Progress report: Development of assessment and predictive metrics for quantitative imaging in chest CT
Subaward No: HHSN268201000050C (4a)
PI: Ehsan Samei
Reporting Period: months 1-3

Deliverables:

1. *Deployment of a framework for drawing a correspondence between simple FOM and quantitative imaging performance in CT.*

   The definition of the framework was almost completed. Estimability index (e') was defined to assess CT volume quantification precision using FOMs including noise (noise power spectrum, NPS), resolution (modulation transfer function, MTF), and a task function that describes the quantitative task. Initial results show a strong correlation between e' and the precision of volume quantification. Efforts remain in expanding the NPS and MTF measurements from 2D to 3D to better represent volume-related quantitative tasks.

   The verification of the framework is completed covering a range of reconstruction algorithms (FBP, ASIR, MBIR) and dose levels. More imaging conditions is being considered to verify the generalizability of the framework.

2. *Table of strengths and weakness of current phantoms for assessing quantitative imaging performance.*

   The ACR CT Accreditation Phantom (model 464) is currently employed for measurements of NPS and MTF across various dose levels. Another phantom with various sizes has just been developed at Duke and shows strength in providing 3D MTF and NPS incorporating patient size dependency and tube current modulation effects. Additional phantoms are being sought for completeness. The comparison between phantoms is underway while the framework in Deliverable 1 is being finalized.

3. *Identify tolerances and threshold that CT quantification requires in terms of FOM measured on QA phantoms and recommend guidelines for compliance of quantitation techniques (software and hardware).*

   Initiated but this is still in early stages. This awaits a calibration process of the correlation between e' and the precision of volume quantification, which will map each calculated e' to a predicted precision. Thresholds of precision can be drawn thereupon to recommend guidelines for compliance.

Work in the coming period will focus on completing the definition of the framework by expanding MTF and NPS measurements to 3D as well as training a 3D task function if necessary. To ensure the framework's applicability to a wide range of imaging conditions, the framework might be evaluated across more imaging conditions and across different phantoms.