

# The QIBA MSK Biomarker Committee

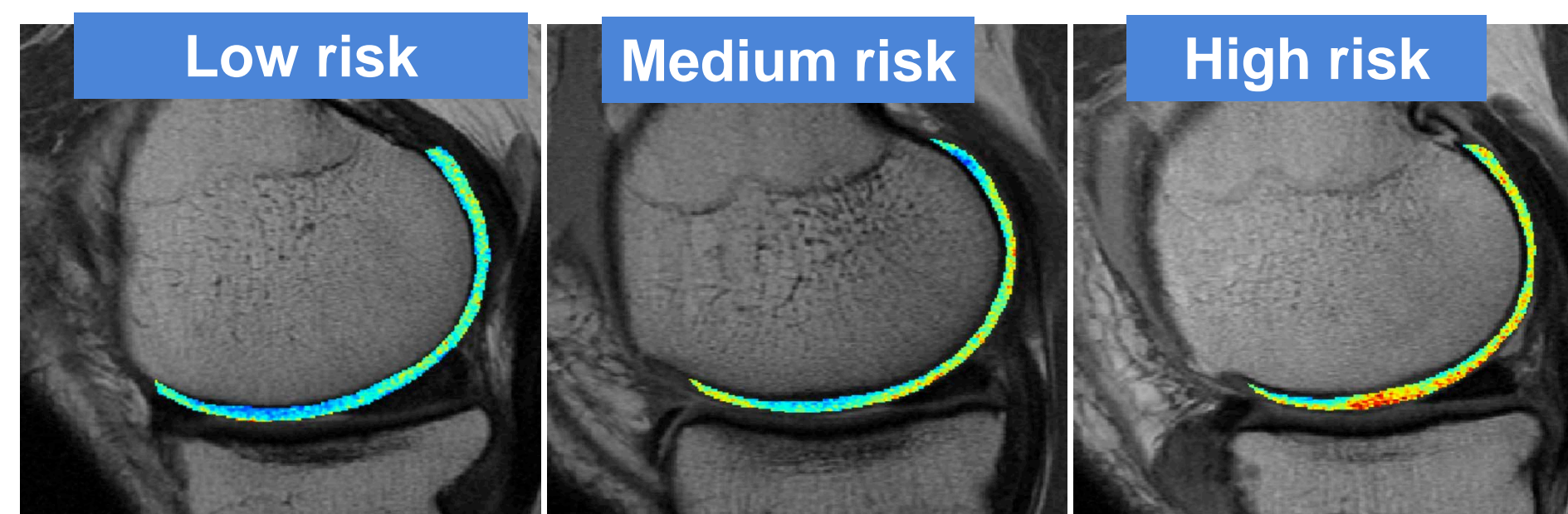
## MR-based cartilage compositional biomarkers ( $T_{1\rho}$ , $T_2$ ) for risk prediction, early diagnosis and monitoring of treatment of degenerative joint disease

### Background



- Osteoarthritis is a major health concern for our aging population.
- Most frequent cause of disability in individuals older than 55 years (National Center for Health Statistics, 2009).
- Devastating impact on mobility and professional activity.
- Biomarkers for better risk assessment, diagnosis at early stages and monitoring of osteoarthritis will have a significant impact on public health.

### Cartilage MRI Biomarkers



Medial Femur  $T_2$  30 ms      Medial Femur  $T_2$  38 ms      Medial Femur  $T_2$  42 ms

- $T_{1\rho}$  and  $T_2$  cartilage compositional biomarkers provide information on cartilage quality before cartilage tissue is lost.
- May predict risk of developing Osteoarthritis, → life style changes.
- Allow to monitor interventions.

### Goals and Claims

Development and dissemination of technical performance standards for compositional cartilage imaging biomarkers

#### PRELIMINARY CLAIMS

- Cartilage matrix composition reflected by the  $T_2$  and  $T_{1\rho}$  relaxation time values is measurable with MRI at 3T with a within-subject coefficient of variation of 4-5%.
- A measured increase in  $T_2$  and  $T_{1\rho}$  of 11-14% or more indicates that a true/critical change has occurred with 95% confidence.

### Profile Stages



Establish Claims.

**Profile details** includes standardized subject handling, image data acquisition and analysis.

**Need to establish Quality Control criteria.**

**Conformance specifications** includes image acquisition sites, MRI devices, reconstruction software and hardware.

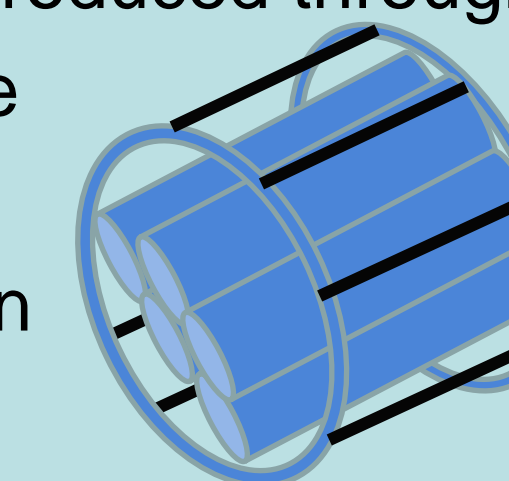
**References:** (1) Schneider E et al. Osteoarthritis Cartilage. 2013 Jan;21(1):110-6, (2) Mosher TJ et al. Radiology. 2011 Mar;258(3):832-42, (3) Li X et al. Osteoarthritis Cartilage. 2015 Dec;23(12):2214-2223 and (4) Li X et al. J Magn Reson Imaging. 2014 May;39(5):1287-93

### Update and Current Groundwork Projects

#### ➤ Calibration Phantom Project

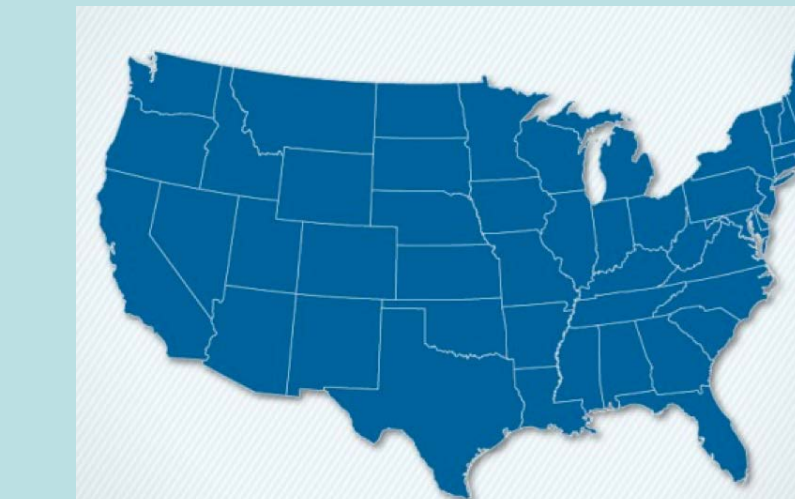
To develop dedicated phantoms for calibrating measures of morphology and composition of MSK tissues (e.g. articular cartilage), and for MSK coils.

**Phantoms** with different concentrations of agarose gel have been developed at UCSF and used for an Arthritis Foundation-sponsored multi-site study (UCSF, HSS, Mayo). Phantoms with the same design have been produced through the GE/NBA project and Phantom Lab. These phantoms will be used in the GE/NBA project at different sites and in an Arthritis Foundation Cross Calibration study.



#### ➤ Multi-Vendor Multi-Center Study

A **cross-calibration study** has been funded by the Arthritis Foundation ((Cleveland Clinic, UCSF, University of Kentucky, Albert Einstein College of Medicine) and data from ongoing GE/NBA study (Stanford, HSS, UCSF) can be used to compare the acquired imaging data from different MR systems (GE, Siemens, and Philips) and sites.



#### ➤ Standardized MRI Protocol

To establish an **MRI protocol** which can be used across different scanners and vendors.

The QIBA MSK Biomarker Committee will work on standardizing protocols of cartilage  $T_2$  and  $T_{1\rho}$  mapping on three MR systems (GE, Siemens, Philips) regarding acquisition sequences (gradient echo-based vs spin-echo based), spatial resolutions, TR/TE, bandwidth and other parameters.



#### ➤ Next steps and how you can participate

1. Obtain funding for larger scale cross-calibration study.
2. Work with NIST (National Institute of Standards and Technology) on developing a MSK calibration phantom.
3. Review current meta-analyses and published studies on clinical application of cartilage  $T_{1\rho}$  and  $T_2$ .
4. Study initiated investigating meaningful longitudinal changes in  $T_2$  using the OAI data.

#### Contacts

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