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## **Overview and Description of Central Image Assessments**

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### **1. Description and objectives**

Standardized measurements and interpretations of OAI images from selected samples of participants using documented methods are available to facilitate research. The primary, but not exclusive, focus of these assessments will be longitudinal structural outcomes of osteoarthritis.

These data will derive from central image assessments sponsored by the OAI, or performed under the supervision of OAI, using methods and samples designed with input and authorization from the OAI Steering Committee.

In addition, central image assessments sponsored by OAI collaborators and data users for their own investigations have been made available for inclusion in OAI public use datasets.

Central image assessments are performed by qualified vendors selected by the OAI or other sponsors.

The detailed methods used by vendors for central image assessments can be found in the descriptive documentation available in the documentation file that accompanies the corresponding dataset file.



**Appendix A**, below, summarizes the central image assessment datasets that are available and selected datasets planned for future release.

For general information on how to use the OAI data, formats, SAS special missing value codes, and more, please see the “*Getting Started with OAI Data: Overview of Structure, Use and Conventions*”.

## 2. Types of assessments

Central assessments are made on images from radiographs, MRI and DXA scans using methods that fall into three broad categories:

1. Qualitative and semi-quantitative (SQ): measurements of OA-related findings and abnormalities defined as either present/absent or measured on ordinal scales ranging from normal to abnormalities of increasing size or severity (e.g., Kellgren-Lawrence grades; joint space narrowing grades; cartilage lesion grades; MOAKS, WOMMS and BLOKS scoring of OA-related structural changes in knee MRI).
2. Quantitative: measurement of OA-related findings on continuous scales of dimensions, widths, volumes, etc. (e.g. cartilage volume; joint space width, trabecular bone structure, bone mineral density).
3. Quantitative measurements of the three-dimensional shape of structures in the knee joint which are then provided as dimensionless scores related to differences between an individual knee’s shape and some mean shape.

These categories include morphological measurements of joint tissue and structures (e.g., cartilage thickness; bone shape) as well as measurements intended as indicators of joint tissue composition or integrity (e.g. MRI signal abnormality and heterogeneity).

## 3. Samples

### 3.1 Semi-quantitative x-ray readings

Semi-quantitative (SQ) x-ray readings, from baseline thru 48-month follow-up visits, including Kellgren and Lawrence grades and OARSI joint space narrowing grades are now available longitudinally **in every OAI participant** who had at least one follow-up visit knee x-ray, regardless of their subcohort assignment. In those participants who had radiographic knee OA at any time point (KLG $\geq$ 2), other radiographic features such as osteophytes, sclerosis and cysts were also scored. These readings (Vendor=BU, Project=15) have replaced any previous SQ x-ray readings for these participants. For participants who only have a baseline visit knee x-ray, the only SQ x-ray readings available are the “quasi” Kellgren and Lawrence performed in the clinic at the study screening visit (OAI variables P01OAGRDR and P01OAGRDL for right and left knees respectively; these variables are in the Biomarkers00 and AllClinical00 datasets).

Semi-quantitative x-ray readings including the 72-month and 96-month follow-up visits, including Kellgren and Lawrence grades and OARSI joint space narrowing grades are now available longitudinally, in Project 37 (or 42), for the entire 96-month follow-up of OAI for knees that were KLG 0-1 at baseline and KLG 0-2 at all time points prior to the 72-month visit. A random selection of knees that were KLG 2-3 at baseline also have semi-quantitative readings at 72-month and 96-month follow-up visits in Project 37 (or 42). **Please note that although some participants are coded READPRJ=42, they are in fact participants in Project 37. Users should recode these participants from READPRJ=42 to READPRJ=37.**

Please see the PDF file kXR\_SQ\_BU\_descrip.pdf provided with the datasets for further information about Projects 15 and 37 (or 42).



### 3.2 Quantitative x-ray joint space width measurements

Quantitative longitudinal joint space width (JSW) measurements, from baseline thru 96-month follow-up visits, including minimum medial compartment JSW, and fixed location JSW measurements at various positions in both medial and lateral compartments of the knee are now released (Vendor=Duryea, Project=16), as summarized below:

- **Progression subcohort:** both knees of all participants
- **Incidence subcohort:** all knees with radiographic OA, plus a large number of knees without radiographic OA (Radiographic OA defined as KLG $\geq$ 2 from Projects 15/37/42 summarized in section 3.1)
- **Non-exposed control subcohort:** both knees of all participants

Please note: any knees that were end stage ROA (KLG=4 or very narrow JSW) at 48-months did not have their JSW measured at the 72-month and 96-month visits.

See the OAI “*Study design protocol*” for additional information on the topic of subcohort assignment.

Please note: any prior JSW measurements performed for other projects have now been replaced by Project 16 measurements.

### 3.3 MRI measurements of cartilage morphology

In 2006, the OAI made available the knee MRIs from baseline and 12-months for a representative sample of 160 participants in the Progression subcohort (Image Group B). Longitudinal MRI assessments of cartilage morphology in these images by several different vendors in projects sponsored by the OAI and its collaborators are among those included in public use datasets (please see the respective dataset descriptions for additional information about this group.)

The OAI Steering Committee has also authorized MRI image assessment projects focusing on a “Core Image Assessment sample” of participants from the Progression subcohort who will have bilateral longitudinal assessments of knee radiographs and, in a subset of “index knees” (n ~600), longitudinal assessments of knee MRIs (Vendor=Eckstein, Project=09). These “index knees,” in addition to having frequent symptoms at baseline, have a K-L grade of 2 or 3 based on a central reading. In addition to providing structural outcome data, multiple assessment methods can be applied in this sample of index knees, allowing comparisons among methods in changes measured over time.

Originally, public datasets of longitudinal MRI assessments sponsored by individual OAI collaborators and data users have focused largely, though not exclusively, on participants in the Progression subcohort and have selected samples with a variety of characteristics appropriate for addressing their specific research questions.

In early 2015, measurements of longitudinal MRI assessments of cartilage morphology performed as part of the OA Biomarkers Consortium FNIH Project were released (as Project=22). This comprises 600 knees measured at baseline, 12-month and 24-month visits, and has a slight overlap with Project 09.

### 3.4 MRI measurements of other structural features of knee OA

In early 2015, the OAI made available other measurements from knee MRI scans including measurements of 3D bone shape by iMorphics, and various parameters of the subchondral bone plate by QMetrics. These data are also from the 600 knees in the OA Biomarkers Consortium FNIH Project (Project=22).



### 3.5 Semi-quantitative MRI (MOAKS) readings of structural features of knee OA

In mid-2015, the OAI made available semi-quantitative readings of structural features from knee MRI. These data are also from the 600 knees in the OA Biomarkers Consortium FNIH Project (Project=22).

### 3.6 Trabecular bone and mineral density measurements

In late 2016, the OAI made available measurements of trabecular bone structure from MRI and bone mineral density from DXA scans that were acquired as part of the Bone Ancillary Study (Project=62).

## 4. Datasets

Each dataset contains image assessments by a single vendor from images acquired at one time point (e.g., all of a vendor’s assessments of baseline images). A dataset may include separate assessments of the same image made for multiple projects by that vendor. Each project focuses on a specific sample of OAI participants (or knees) and a specific set of time points, usually selected to address a specific research question. For example, one project from a vendor could be a longitudinal assessment of baseline and 12-month image pairs in one sample of participants and a different project could be a longitudinal assessment by the same vendor of baseline and 12-month image pairs in a different sample of participants (see Example 1, below). Or, two different projects by the same vendor may include the same knees, but one assesses baseline and 12-month image pairs and the other assesses baseline and 48-month image pairs (see Example 2, below). The baseline assessments for both projects by the vendor would be in the same dataset, but the 12-month data from one project would be in the 12-month dataset for that vendor while the 48-month data from the other project would be in the 48-month dataset for that vendor.

#### Example 1

<b>Baseline dataset for vendor Y (DatasetForVendorY00) contains the following:</b>	<b>12-month dataset for vendor Y (DatasetForVendorY01) contains the following:</b>
Project 01 (n=100 in progression subcohort)	Project 01 (n=100 in progression subcohort)
Project 02 (n=100 in incidence subcohort)	Project 02 (n=100 in incidence subcohort)

#### Example 2

<b>Baseline dataset for vendor Z (DatasetForVendorZ00) contains the following:</b>	<b>12-month dataset for vendor Z (DatasetForVendorZ01) contains the following:</b>	<b>48-month dataset for vendor Z (DatasetForVendorZ06) contains the following:</b>
Project 03 (n=50)	Project 03 (n=50)	
Project 04 (n=50; same group studied in Project 03)		Project 04 (n=50; same group studied in Project 03)

Please note: the Bone Ancillary Study (Project=62) variables from different visits are contained in one dataset named BoneAncillaryStudy. Variables from different visits can be distinguished from one another by their visit prefix (see the “*VisitPrefixDefinitions.pdf*” document or a guide to visit numbering). Also note that for this Bone Ancillary Study dataset, there are separate variables for which knee (KNEESIDE) and hip (HIPSIDE) were analyzed.



## 5. Defining change between time points

DO: Data from different time points within the same project are designed to be analyzed longitudinally for change between time points. For example, Project 09 data from baseline images can be directly compared with Project 09 data from 12-month visit images because the assessments were performed with the images from different time points paired (or grouped) or were otherwise designed to permit direct comparison.

The data from a vendor's assessment of baseline images are in datasets ending in "00", while the corresponding data from this vendor and project for the 12-month images are in datasets with the same name, but ending in "01" and so on. (See the "*VisitPrefixDefinitions.pdf*" document for a guide to visit numbering). To compare values of a variable from a given vendor and project across time points, or to calculate change scores, users will need to merge the datasets for the different time points (See Strategies for Merging and **Appendix B**, below).

DON'T: In general, users are advised NOT to define change in a knee between two time points using data from one project for one time point and data from another project for a different time point, even when the two projects are done by the same vendor. This is because the assessments from the two time points were not done with the images paired (grouped) or otherwise designed to permit direct comparison. Any exceptions to this rule are clearly spelled out in the documentation for each dataset and project.

Please note: for the semi-quantitative readings described in section 3.1, the OUTCOMES99 dataset contains pre-calculated variables for incident radiographic OA from baseline based on Kellgren and Lawrence Grade (KLG) changes from baseline and progression based on joint space narrowing (JSN) score changes from baseline.

## 6. Pooling change data from different projects of the same vendor

MAYBE: Users may wish to explore pooling longitudinal data from different projects by the same vendor, e.g., change data for a sample of knees from one project by a vendor pooled with change data for a different sample of knees from another project by the same vendor. The assessment methods, participant/knee selection criteria and sample characteristics from the different projects should be evaluated carefully before pooling. Appropriate statistical analyses should be used for the combined samples, such as including indicator variables for project identifier as a covariate in statistical models. Some of the same considerations apply to using data from one project or sample for purposes other than that for which they were designed.

One important scenario where it may be important to examine readings from different projects from the same vendor is for examining incidence of radiographic OA by combining data from readings of KLG and JSN from knee x-rays from Projects 15 and 37 (or 42). Please see the PDF file *kXR\_SQ\_BU\_descrip.pdf* for further information about Projects 15 and 37 (or 42) and how to merge data from the *kXR\_SQ\_BUxx* SAS datasets that contain data for these projects.

## 7. Pooling change data from different vendors

DON'T: Users should NEVER attempt to define change at an anatomic site using data from different vendors for different time points (e.g. a baseline assessment from one vendor and a follow-up assessment of the same knee from another vendor) even if the assessment methods appear to be similar.

MAYBE: Users may wish to explore pooling longitudinal data from different vendors, e.g., change data between two time points for a sample of knees from one vendor with change data from a different vendor for the same time points but in a different sample of knees. For example, quantitative assessments of cartilage volume for an ROI that is defined in the same or nearly the same way by two different vendors may be similar enough to be pooled for an analysis. However, the decision to pool should be based on a careful evaluation of the comparability of changes between different vendors in the same knees and time points.



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## 8. Dataset structure for central image assessments

- Each dataset contains data produced by a single vendor.
- There is a separate dataset for each time point for each vendor.
- A dataset may contain multiple rows of data (records) per participant (e.g., left knee, right knee).
- A dataset may contain multiple rows of data (records) per anatomic site (e.g. multiple rows for a given participant's left knee).
- The variable SIDE denotes whether the row of data is for a right side image (SIDE=1) or a left side image (SIDE=2), (for example, both knees of a bilateral fixed-flexion knee x-ray may be read, so that the image barcode - assigned to the bilateral film - does not differentiate between records, but SIDE does).
- Each row (record) in a dataset corresponds to data for one participant, one anatomic site, one side and one image assessment project. The variable for project number is READPRJ, and the value for this variable is the two-digit project number. Please see **Appendix A, Tables 1b and 2b**, for the number assigned to each image assessment project.
- If the same anatomic site, side and time point was assessed for more than one project by a given vendor, that anatomic site, side and time point will have separate records for each project within the dataset.
- In order to ensure that data from different time points were generated from an assessment designed to permit analysis of change over time at an anatomic site, the data must be from the same project number (see the project number variable, READPRJ).
- The variables uniquely identifying a record in these datasets are ID, SIDE, and READPRJ and the datasets are sorted by ID, then SIDE, followed by READPRJ.
- SAS variable label length is a maximum of 160 characters. Analysts are encouraged to always output and view SAS variable labels in their entirety to ensure important information about the variables is not lost.

**Please note:** when viewing data distributions for individual variables in the documentation (e.g., Variable Guides), the distributions combine the data for all projects in the dataset that include that variable. For example, variable V00XYZ in a baseline dataset that contains 2 projects, both of which provided a reading for this variable, will display the data for all assessments done in both projects. When working with the data in SAS or another analysis program, the user can use the READPRJ variable to create a frequency that is subset by project for the variable of interest.

## 9. Strategies for merging datasets

**Appendix B** gives an example of how to merge central image assessment datasets from different time points for the same vendor and project.

Users will also want to merge central image assessment data with clinical data about the anatomic site and the person. Please see **Appendix C** for example SAS code. The result of this merge would assign a participant's characteristics (e.g., age) to each of their records in the image assessment dataset.

Users may also want to identify the specific image that was assessed to generate the data for an anatomic site and time point and merge the image assessment data with meta-data about that image (please see **Appendix D** for example SAS code). Individual images (radiographs, MRI series) are identified by a unique barcode. The barcode is recorded in the AccessionNumber in the DICOM header of the image. (See the "*DicomImageReleaseNotes.pdf*" for more information about the DICOM headers.) Image meta-data are in the **XrayXX** and **MRlxx** datasets (where XX denotes the visit), with the meta-data for an image identified by its barcode (VxxXRBARCD for x-rays, VxxMRBARCD for MRI). Each row (record) of an image assessment dataset includes a variable for the barcode (VxxBARCDxx) for the image/series that the data were



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derived from. The value for VxxBARCDxx in the image assessment dataset should match the value for the barcode in the **XrayXX** or **MRlxx** meta-data datasets. **Appendix E** gives an example of how to generate and print a list containing participant ID, knee and image barcode for every participant in a given image assessment project.

#### **10. Calculating duration of follow-up**

The meta-data datasets for images (**XrayXX** and **MRlxx**) include variables for the date on which the image, identified by its unique barcode, was acquired (VxxXRDATE, VxxMRDATE). By comparing acquisition dates between images the duration of follow-up can be calculated. All dates in the OAI datasets are SAS dates, represented as the number of days since January 1, 1960. Thus, even if SAS is not the analytic software being used, the number of days between any two dates can easily be calculated as the difference between the two SAS dates.

#### **11. Reading methods and variables**

Reading methods and variables are described in the documentation for each dataset.



**Appendix A. Summary of central image assessments and datasets.**

<b>Table 1a. Total number of subjects (knees) with longitudinal central knee x-ray assessments as of 3/4/2016</b>						
Type (Vendor, Project #)	BL-12mos	BL-24mos	BL-36mos	BL-48mos	BL-72mos	BL-96mos
Semi-Quantitative, K-L, IRFs (Boston University-Felson/ 15;Aliabadi & Sack/ 37 (or 42))	4,219 (8,438)	3,977 (7,954)	3,815 (7,630)	3,656 (7,294)	2,164 (3,577)	2,206 (3,672)
Quantitative JSW (Duryea, 16)	3,268 (5,874)	3,088 (5,544)	2,979 (5,349)	2,855 (5,134)	2,166 (3,557)	2,254 (3,689)
Quantitative Femoro-Tibial angle (Duryea, 17)	3,234 (5,807)	3,058 (5,482)	2,961 (5,313)	2,836 (5,092)	2,149 (3,526)	2,237 (3,657)
Subchondral Bone Trabecular Integrity (BTI)	582(582)	600(600)	N/A	N/A	N/A	N/A



**Table 1b. OAI central X-ray assessment projects and datasets. Updated 3/4/16**

Image type	Measurements	Vendor/ project #	N of ppts (knees)	Sample	Time points	Release date (MM/YY)	Dataset name (where xx designates the visit)
Knee x-ray (F-F)	K-L grade, IRFs	Boston University-Felson/ 15  Aliabadi & Sack/ 37 (or 42)	4,492 (8,984)	Entire cohort, both knees (excluding people with only one visit) 72m/96m only read in knees eligible for developing radiographic OA	BL, 12mos, 24mos, 36mos, 48mos, 72mos, 96mos	5/11 Rereleased 11/11, 6/13, 6/15, 3/16	kXR_SQ_BUxx
Knee x-ray (F-F)	Quantitative JSW	Duryea/ 16	3,469 (6,245)	All knees with radiographic OA at any timepoint, plus a large number of normal knees	BL, 12mos, 24mos, 36mos, 48mos, 72mos, 96mos	5/11 Rereleased 12/11, 6/13, 6/15, 3/16	kXR_QJSW_DuryeaXX
Knee x-ray (F-F)	Femoral-tibial angle	Duryea/ 17	3,435 (6,178)	All knees with radiographic OA at any timepoint, plus a large number of normal knees	BL, 12mos, 24mos, 36mos, 48mos, 72mos, 96mos	6/13, 6/15, 3/16	kXR_FTA_DuryeaXX
Knee x-ray (F-F)	K-L grade, IRFs	Boston University-Felson/ 19A/19B*	149 (298)	Reliability sample from Project 15	BL, 12mos, 24mos, 36mos, 48mos	4/12	kXR_SQ_Rel_BUxx
Knee x-ray (F-F)	Quantitative JSW	Duryea/ 20A/ 20B/ 20C/ 20D+	136 (272)	Reliability sample from Project 16	BL, 12mos, 24mos, 36mos	4/12	kXR_QJSW_Rel_DuryeaXX
Knee x-ray (F-F)	Subchondral bone trabecular integrity (BTI)	Duke/ 22	600 (600)	Knees from the OA Biomarkers Consortium FNIH Project[5]	BL, 12mos, 24mos	6/15	kMRI_FNIH_BTI_DukeXX
Full-limb x-ray	Hip-knee-ankle angle	Duryea/ 32	1,432 (2,864)	Entire cohort	12mos, 24mos, 36mos, 48mos	3/16	f1XR_KneeAlign_DuryeaXX
Full-limb x-ray	Hip-knee-ankle angle	Cooke/ 60	1,237 (2,474)	Progression and Incidence subcohort participants	12mos, 24mos, 36mos, 48mos	2/09 Rereleased 6/13	f1XR_KneeAlign_CookeXX

\* Project 19A are the original readings from Project 15, and Project 19B are the retest readings for Project 15.

+ Project 20A are the original readings from Project 16, Project 20B are the retest readings for Project 16, Project 20C are the original readings from Project 05, and Project 20D are the retest readings for Project 05. Project 05 readings have been removed from the kXR\_QJSW\_DuryeaXX datasets, but a subset of Project 05 readings are included in the kXR\_QJSW\_Rel\_DuryeaXX datasets since retest data is available for these records.



**Appendix A. Summary of central image assessments and datasets.  
-continued-**

<b>Table 2a. Totals of subjects (knees) with longitudinal central MRI assessments as of Q2, 2015</b>			
Type (Vendor, Project #)	BL-12mos	BL-24mos	BL-48mos
Quant Cart sagDESS (VirtualScopics, 03)	150 (150)	0	0
Quant Cart corFL (Eckstein, 04,07,18)	160 (160)	132 (132)	0
Quant Cart corMPR (Eckstein, 08)	80 (80)	40 (40)	0
Quant Cart sagDESS (Eckstein, 9A/9B) *	556 (565)	590 (600)	85 (86)
Quant Cart corFL or corMPR or sagDESS (Eckstein 04,07,08,9A/9B,18) **	669 (702)	702 (732)	85 (86)
Quant Cart sag DESS (Chondrometrics, 22)***	600(600)	600(600)	0
Quant 3D Shape sagDESS (iMorphics, 22)***	600(600)	600(600)	0
Quant Cart Bone Area sag DESS (QMetrics, 22)***	600(600)	600(600)	0
Quant SQ MOAKs multiple MR sequences (BICL, 22)***	600(600)	600(600)	0
Quant Cart Volume sag DESS (Biomediq, 22)***	600(600)	600(600)	0
<p>* Projects 9A and 9B analyze the same knees, but use slightly different definitions of the anatomical location of weight bearing femoral cartilage</p> <p>** Potential for pooling of data from 5 projects. Estimated number of unique knees based on projected overlap between projects.</p> <p>*** Project 22 is the OA Biomarkers Consortium FNIH Project which analyses MRI and x-rays from BL, 12mos, and 24mos visit in the same 600 knees by a variety of methods/vendors.</p>			

Please note: there are also longitudinal assessments of trabecular structure in 629 knees from MRI in the Bone Ancillary Study (Project=62) usually with either 30-month to 48-month visit follow-up, or 36-month to 48-month visit follow-up.



**Table 2b. OAI central MRI assessment projects and datasets. Updated 11/30/16**

Image type	Measurements	Vendor/ project #	N of ppts (knees)	Sample	Time points	Release date (MM/YY)	Dataset name (where xx designates the visit)
Knee MRI	Quantitative cartilage (sagDESS)	VirtualScopics/ 03	150 (150)	Images B (160 Prog ppts); R o rL knees with freq Sxs and osteophytes [1]	BL, 12mos	2/09 Rereleased 5/11	kMRI_QCart_VSxx
Knee MRI	Quantitative cartilage (corFL)	Eckstein/ 04	158 (158)	Images B (160 Prog ppts); R knees [2]	BL, 12mos	2/09	kMRI_QCart_EcksteinXX
Knee MRI	Quantitative cartilage (corFL)	Eckstein/ 07	132 (132)	Images C (1st half of cohort), Prog & Inc ppts; sequential sample by ascending ID); K-L gr 2-3 (central reading); R knees only	BL, 24mos	2/09	kMRI_QCart_EcksteinXX
Knee MRI	Quantitative cartilage (corMPR DESS)	Eckstein/ 08	80 (80)	Knees with BL bilat freq knee Sx and asymmetric JSN (central reading); Images B, all 22 R knees meeting these criteria; Images C, Prog & Inc ppts; sequential sample by ascending ID, 1 <sup>st</sup> 58 R knees meeting criteria	BL, 12mos, (24mos in n=40)	2/09	kMRI_QCart_EcksteinXX
Knee MRI	Quantitative cartilage (sagDESS)	Eckstein/ 9A/B *	556 (565)	Prog subcohort "Core Image Assessment sample"; RorL index knees +	BL, 12mos, 24mos, (48mos in n=85)	10/09 Rereleased 7/10, 5/11, 4/12	kMRI_QCart_EcksteinXX
Knee MRI	MRI features of OA; comparison of WORMS and BLOKS	Boston University-Guermazi/ 10	115 (115)	Progression subcohort participants	BL, 24mos	5/11	kMRI_SQ_BICLxx; kMRI_SQ_BLKSBML_BICLxx
Knee MRI	Quantitative cartilage (corFL)	Eckstein/ 18	906 (906)	Progression and Incidence subcohort participants	BL	5/11	kMRI_QCart_EcksteinXX
Knee MRI	Quantitative cartilage (sagDESS)	Chondrometrics/ 22	600 (600)	Knees from the OA Biomarkers Consortium FNIH Project[5]	BL, 12mos, 24mos	2/15 (in FNIH dataset) 6/15 (in image assessment dataset)	kMRI_FNIH_QCart_ChondrometricsXX kMRI_QCart_EcksteinXX

\* Projects 9A and 9B analyze the same MRI images, but use different anatomical definitions of the weight bearing femoral region used for calculating cartilage morphology measurements.

+ Index knee = "Core Image Assessment sample" knees (images available at BL and 24mos visits) with BL K-L grade 2-3 (from central reading) and frequent symptoms.



**Table 2b continued. OAI central MRI assessment projects and datasets. Updated 11/30/16**

Image type	Measurements	Vendor/ project #	N of ppts (knees)	Sample	Time points	Release date (MM/YY)	Dataset name (where xx designates the visit)
Knee MRI	Quantitative cartilage (sagDESS)	iMorphics/ 22	600(600)	Knees from the OA Biomarkers Consortium FNIH Project[5]	BL, 12mos, 24mos	2/15	kMRI_FNIH_Boneshape_iMorphicsXX
Knee MRI	Quantitative cartilage (sagDESS)	QMetrics/ 22	600(600)	Knees from the OA Biomarkers Consortium FNIH Project[5]	BL, 12mos, 24mos	2/15	kMRI_FNIH_SBP_QMetricsXX
Knee MRI	MRI features of OA; using MOAKS	BICL/ 22	600(600)	Knees from the OA Biomarkers Consortium FNIH Project[5]	BL, 12mos, 24mos	4/15 (in FNIH dataset) 6/15 (in image assessment dataset)	kMRI_FNIH_SQ_MOAKS_BICLxx kMRI_SQ_MOAKS_BICLxx
Knee MRI	Quantitative cartilage (sagDESS)	Biomediq/ 22	600(600)	Knees from the OA Biomarkers Consortium FNIH Project[5]	BL, 12mos, 24mos	4/15	kMRI_FNIH_QCart_BiomediqXX
Knee MRI	Trabecular bone structure (coronal FISP)	McAlindon/ 62 (OAI Ancillary Study AS06-11)	629(629)	Knees from the McAlindon Bone Ancillary Study	30mos, 36mos, 48mos	12/16	BoneAncillaryStudy



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## Appendix A. Summary of Central Image Assessments and Datasets. -continued-

References for Table 2b.

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---

## Appendix B. Example SAS code for merging image assessment data from different time points of the same project.

```
* This is an example of merging a single image assessment variable      ;
* from a given project at two time points, e.g. to create a longitudinal ;
* change variable.                                                       ;

* Remember that the image assessment datasets may combine data from     ;
* different projects, so make sure to subset by project.                 ;

* Create a baseline dataset ;

data BASE1 ;
  set FUNC.KMRI_QCART_ECKSTEIN00 ;
  where readprj = '04' ;
  keep id side V00CBLFMAT ;
run;

proc sort data=BASE1 ;
  by id, side ;
run;

* Create a follow-up dataset ;

data FOLLUP1 ;
  set FUNC.KMRI_QCART_ECKSTEIN01 ;
  where readprj = '04' ;
  keep id side V01CBLFMAT ;
run;

proc sort data=FOLLUP1 ;
  by id, side ;
run;

* Merging them results in one record per knee that has V00CBLFMAT and V01CBLFMAT ;

data BOTHDATA ;
  merge BASE1 FOLLUP1 ;
  by id side ;
run;
```



---

## Appendix C. Example SAS code for merging image assessment data with clinical data.

```
* This is an example of merging a set of data from an image assessment ;
* dataset with data from one of the clinical datasets. For example, ;
* say you were interested in adding the variables indicating ;
* symptomatic knee OA at baseline to the data from image assessment ;
* Project 04. Please read the note at the end of the example ;
* regarding mixing records that have one-record-per-knee with those ;
* that have both knees in every record. ;

* Create a baseline dataset ;

* Remember that the image assessment datasets may combine data from ;
* different projects, so make sure to subset by project. ;

data BASE1 ;
  set FUNC.KMRI_QCART_ECKSTEIN00 ;
  where readprj = '04' ;
  keep id side ;
run;

* Create data of symptomatic knee OA ;

data KNEEOA ;
  set FUNC.JOINTSX00 (keep=id P01RSXKOA P01LSXKOA) ;
run;

* Merge the two datasets ;

data BOTH ;
  merge BASE1(in=in) KNEEOA ;
  by id ;
  if in ;
run;

* Note that in this case, each image assessment record could be either ;
* a left or right knee but each record from the clinical dataset ;
* has both left and right knees in the same record. You will need to ;
* process the data further so that you evaluate the correct ;
* knee-specific symptomatic OA variable depending on the knee used for ;
* the image assessment. ;
```



---

## Appendix D. Example SAS code for merging image assessment data with the image meta-data.

```
* This is an example of merging a set of data from an image assessment ;
* dataset with their respective image meta-data. For example, say you ;
* were interested in obtaining the MRI scan date for a set of baseline ;
* scans in image assessment Project 04. ;

* Remember that the image assessment datasets may combine data from ;
* different projects, so make sure to subset by project. ;

* Create a baseline dataset ;

data BASE1 ;
  set FUNC.KMRI_QCART_ECKSTEIN00 ;
  where readprj = '04' ;
  keep id v00mrbarcode ;
run;

* Merge on id and barcode. Not necessary to merge on knee since every ;
* barcode references a knee-specific image, or just a single image, in ;
* cases where 'side' has no meaning, such as a pelvis X-ray. ;

data DATES ;
  merge FUNC.MRI00(keep=id v00mrdate v00mrbarcd)
        BASE1(in=inbase rename=(v00mrbarcode=v00mrbarcd)) ;
  by id v00mrbarcd ;
  if inbase and V00mrbarcd ^= ' ' ;
run;
```



---

## Appendix E. Example SAS code for generating a list of participant ID, knee and image barcode for every participant in an image assessment project.

```
* An example to print list of participant ID, knee, and image barcode ;
* for every participant in image assessment Project 03. ;
* In this example, we are using the baseline dataset, KMRI_QCART_VS00.;

* An image assessment dataset may contain data for multiple projects ;
* so it is usually wise to subset data just to the desired project. ;

data TMP1 ;
  set FUNC.KMRI_QCART_VS00 ;
  if readprj = '03' ;
  keep id side V00BARCDVS ;
run;

* Sort list according to your preference. Some projects may allow a ;
* given knee to appear more than once in the data, and if you would ;
* like to only reference each knee once, then you may add the ;
* NODUPKEY option to the PROC SORT command. ;

proc sort data=TMP1 ;
  by id side ;
run;

* Generate list of knees and accompanying barcodes and knee ;
* information. ;

proc print data=TMP1 ;
run;
```