Imaging-based endpoints are well-established and have an increasingly valuable impact on musculoskeletal (MSK) clinical trials. Accelerated understanding of a drug’s effect on safety and efficacy lays the foundation for a solid decision-making process.

Our team understands the challenge sponsors face in designing multicenter clinical research trials. In MSK studies, there are many reasons why it is critical to have extremely tight control of image and reading quality in order to show the superiority of a new treatment. Reasons may range from ethical considerations regarding placebo control groups, varying degrees of treatment naiveté or response levels of patients, and the absence of initial radiographic structural damage for some patients. At PAREXEL, our ultimate goal is to achieve optimal image quality required for accurate and precise assessments by expert readers for MSK studies. Paying special attention to consistent imaging at baseline and follow up, we are able to deliver high-quality imaging and assessments in order to increase the sensitivity and power to show treatment effects.

Imaging endpoint assessments are highly dependent on analysis techniques/scoring criteria, assessment guidelines and image reviewer expertise. Additionally, the varying standards and methods used at investigative sites introduce sufficient bias and variability, which can jeopardize the identification of true eligibility, safety and efficacy differences among treatment groups. Central independent collection and analysis with PAREXEL helps improve image quality and standardize data.

**Key Benefits**

- A highly trained team and application of imaging best practices and experience to deliver superior service quality and efficiency gains
- Standardized global coverage with imaging specialists located across offices in US, Japan, India and Germany to oversee training, site visit, and site support needs
- Higher-quality data capture through access to key opinion leaders (KOLs) and ability to facilitate in-depth engagement of KOLs in approval of analysis design
• Faster, reproducible, and more accurate analysis and data enabled by advanced monitoring and tracking tools

• Risk mitigation based on best practices gained through extensive trial management experience

Musculoskeletal Expertise
As a leading imaging provider for clinical trials, we offer multiple solutions to standardize musculoskeletal imaging endpoint assessments. With PAREXEL Informatics, you get the knowledge and expertise accumulated from our experience of supporting over 177 musculoskeletal imaging studies. When you work with us, you can be confident that you are working with a world leader in MSK imaging.

The structure and expertise of our global organization is aligned to adjust and scale imaging services to your needs. We have the specific expertise and flexibility that you should expect from your imaging partner for early phase, adaptive or exploratory imaging studies. In addition, we have the know-how to implement large late phase submission trials effectively and efficiently with rigor.

Experts
PAREXEL brings the world’s leading experts to your musculoskeletal imaging studies. Our in-house musculoskeletal imaging experts draw from their impressive clinical experience and imaging know-how to provide optimal medical support for your studies.

Our team possesses intimate understanding of the regulatory requirements and includes Ken Faulkner and Sally Warner. Dr. Ken Faulkner holds a Ph.D. in Biomedical Engineering with over 20 years of experience in the design and execution of pharmaceutical studies with imaging endpoints, including the use of X-ray, CT, MRI, PET, ultrasound and DXA for the assessment of bone and cartilage disease. He holds three patents related to the use of imaging for the assessment of osteoporosis and has published over 70 scientific articles in the area of osteoporosis diagnosis and treatment. Dr. Warner, Ph.D, is a certified Clinical Densitometrist with the International Society for Clinical Densitometry, and has over 15 years of experience with musculoskeletal imaging including DXA, QCT, histomorphometry, MRI and X-ray.

We also have extensive experience working with a full range of well-known MSK KOLs and criteria authors as consultants and readers.

Standard Imaging Musculoskeletal Endpoints
PAREXEL Informatics has proven capabilities for supporting all of the standard modalities used by investigative sites for routine imaging of musculoskeletal patients. With a team of experienced in-house medical imaging experts, including several radiologists, an MR physicist and a dedicated MSK group, we are fully equipped and optimally positioned to support your MSK trials.
### Operational Excellence

Guiding your project through every step of the process is a dedicated team of experts focused on meeting the specific requirements of your protocol. Consisting of a director of operations, project manager, imaging operations lead, medical director, medical writer and imaging specialists, and where needed external scientific advisors, the team is focused on delivering the highest levels of project rigor and quality service.

Our in-house medical imaging experts provide consultation on developing the imaging component of your protocol and the analysis design. We ensure a standardization of image acquisition, as well as collection and processing of all images in a central digital repository. Our imaging specialists will compare all visits back to baseline to ensure consistent positioning (e.g., angulation measurements on hand XR studies) and adequate anatomical coverage, check for use of positioning devices, confirm acceptability of image resolution, and safeguard scanner consistency for the duration of the trial. For quantitative MSK studies including DXA and QCT, our imaging specialists are certified to perform the final analysis. In addition to rigorous training and testing of reviewers, our medical experts will conduct ongoing quality checks of the reviewers’ case assessments and reports as well as perform outlier analysis on all data exports including DXA and QCT to verify accurate results before database lock. These practices enable independent and unbiased evaluation of images and provide high-quality image analysis data.

Partnering with PAREXEL means access to our worldwide network of reviewers. Our Global Reviewer Operations group is focused on the management of both on-staff and independent reviewers. The flexible reviewer model allows the freedom to choose between our in-house staff and
independent reviewer network as well as any experts identified by the sponsor.

To supplement training provided at investigator meetings, our seasoned experts can provide advanced on-site training customized to individual customer requirements. This is especially valuable in osteoarthritis studies where our imaging specialists program MR scanners and help the technician acquire a test image on-site. We also offer international training via webcasts for radiology and trial staff and produce training materials such as CD-ROMs with content required for investigator sites. We can qualify the radiology departments of your investigator sites and confirm that all sites are able to acquire the images according to mutually developed standardized image acquisition guidelines. Our project managers are experienced and trained on the complexities of MSK trials. Their knowledge of phantom management, imaging parameters, MSK-specific risks and best practices provide a superior customer experience.

Advanced Technology Tools
PAREXEL Informatics MSK solution is underpinned by an integrated suite of proprietary technology tools specifically designed to provide built-in expertise and rigor and are configurable to support the specific requirements of your protocol. With embedded analysis workflows and criteria rules to streamline the entire process, the combined applications provide superior, intuitive user experiences while facilitating total data quality:

- Advanced analysis technology with embedded criteria rules which include tight integration of electronic case report forms with image analysis application and automated calculations for the reviewer based on measurement recording and updating
- Core applications available for rheumatoid arthritis, osteoarthritis, spine fracture and DXA and further option of fully customized applications fitting study specific needs
- MSK medical outlier analysis on all studies including automated DXA outlier reports for Hologic and GE Lunar imaging data
- Advanced reporting solution for real-time access to imaging and trial data including Metrics Champion Consortium (MCC) report card metrics
- Integration with ClinPhone® RTSM (Randomization and Trial Supply Management) to facilitate real-time queries on patient statuses, enabling proactive patient management and swift reporting of screening confirmation (T-scores, fractures, etc.) and excessive bone change
- Integrated technology with OptasiaMedical analysis tools
- Spine fusion measurement tools including translation, lordosis/kyphosis, flexion and extension, vertebral height and morphology
- Visiana BoneXpert™ analysis software for bone age determination
- DXA and QCT advanced tools to ensure clean and high quality data
  - QCT analysis for bone density and morphology using Mindways QCTPro™ software and FEM analysis using O.N. Diagnostics technology
  - Integrated image tracking workflow with DXA Hologic and GE Lunar software for storage of all proprietary image formats in one clean repository with audit trail capabilities. Easy access for imaging specialists to have read-only access to previously analyzed images to ensure proper region of interest placement.
  - Instrument Quality Control for streamlined DXA collection, automated Shewhart rule violation calculations and correction factor generation
- Arthritis positioners provided by PAREXEL to ensure reproducible subject positioning across all sites, subjects and timepoints

Part of the Perceptive MyTrials® framework, enabling integration with clinical trial software applications to help users plan, design and conduct clinical trial programs in a single place.