

# Associate Member Leverages the QIN and Receives Large National Grant

## Tata Memorial Centre Receives National Grant

Tata Memorial Centre (TMC), an Associate Member of the QIN, was awarded a large Indian national grant with the goal to establish an Artificial Intelligence (AI) Laboratory. Active interactions with the QIN members made it possible for the TMC group to successfully compete for India's highly competitive national grant. Recognizing AI's potential to transform India's economy, the Government of India authorized Aayog, a think-tank group within the National Institution for Transforming India (NITI), to develop a national strategy on artificial intelligence and other emerging technologies, moving forward. NITI's Aayog has collaborated with several leading AI technology companies to implement AI projects in critical areas within agriculture and health. An AI-based Radiomics project supported by NITI's Aayog in collaboration with Tata Memorial Centre Imaging Biobank, a Machine Learning and Artificial Intelligence Database and Tumor Radiomics Atlas Project for cancer, is currently underway. This collaboration is expected to generate imaging biomarkers for use in research studies and support biological validation of novel and currently existing imaging biomarkers. The long-term strategy is expected to provide an unprecedented opportunity to improve decision-support in cancer treatment at low cost.

In addition to this significant achievement, Tata Memorial Centre was among the top performers in the MICCAI Multimodal Brain Tumor Segmentation (BraTS) 2018 challenge. BraTS focuses on the evaluation of state-of-the-art methods for the segmentation of brain tumors in magnetic resonance imaging (MRI) scans. Their survival prediction model for glioblastomas, through continuous support from Dr. Pushpa Tandon (QIN Deputy Administrative Director) and Dr. Jayashree Kalpathy-Cramer (QIN Principal Investigator from Massachusetts General Hospital), was awarded "TOP PERFORMER" for this year. They were invited to present their results at the MICCAI prestigious conference in Granada, Spain this year.

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<https://metamorphoses.in/blog/2018/4/13/embrace-ai-on-a-war-footing>

<https://becominghuman.ai/salient-features-of-niti-aayogs-national-strategy-for-artificial-intelligence-india-5d6865e95090>

Two new associate member groups from Ireland and Germany introduced their programs at the last QIN annual face-to-face meeting in May. Dr. Finbarr O’Sullivan, Ph.D., professor and head of the Department of Applied Mathematics and Statistics, University College Cork in Cork, Ireland presented an overview of his group’s work in advanced image analysis and data modeling. Among the group’s interests are approaches to tumor biologic heterogeneity through image segmentation and features analysis combinations, and image-based outcomes models.

Dr. Winfried Brenner, M.D., heads the group in Berlin, Germany at the Charite/Medical University. His group is focusing on quantitative imaging approaches in molecular imaging and therapy. They also have ongoing work in image analysis to quantitate tumor heterogeneity and its implications for cancer therapy.

Both groups look forward to the interactions with QIN to forward their work in quantitative Imaging and as opportunities for junior investigators to connect with the QIN community. The QIN extends them a warm welcome!

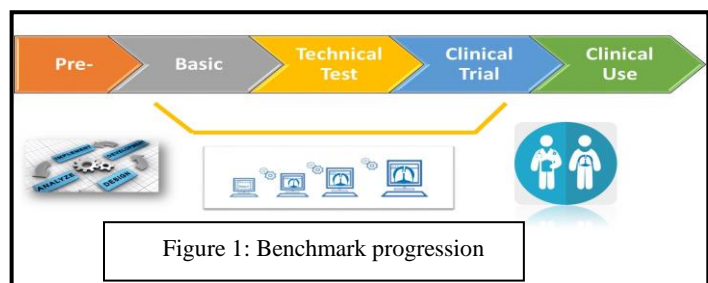
## QIN Benchmarks Update for Tools and Methods

To date, thirty-six multidisciplinary teams from academic institutions across the United States and Canada have participated in the QIN. The current number of teams supported by the network is 21. Participating investigators have received up to 5 years of support and have entered the network at different points in times and thus are at different stages in their tool development and validation. As the QIN moves towards clinical translation, the need for benchmarking to determine the clinical readiness that each quantitative tool has attained was apparent.

The current catalog of QIN tools contains 67 clinical decision support tools in various stages of development. Because of the staggered entrance of teams into the network, progress in development of the tool is not uniform across the network. This has created the need for benchmarking as a measurable way to evaluate tool development status. Of the tools listed in the catalog, there are approximately a dozen that are to the point of entering in the clinical domain and qualifying for benchmark level 4 or 5. The benchmarking initiative allows investigators the opportunity to adjust their algorithms prior to committing to a specific prospective clinical trial.

A task force comprising of QIN investigators and NCI program staff developed QI Benchmarks as standard labels that signify the development, validation, and clinical translation of quantitative tools through a 5-tier benchmark system as exemplified in the following stage representation levels: Pre-Benchmark (Level 1), Basic Benchmark (Level 2), Technical Test Benchmark (Level 3), Clinical Trial Benchmark (Level 4), and Clinical Use Benchmark (Level 5).

In general, requirements for each Benchmark designation requires a peer-reviewed publication, where the scientific goals, methods and results of the quantitative imaging biomarker development or analysis are described. A benchmark is not automatically conferred on a QIN tool. The developer must make an application which includes the



required information for that benchmark as well as a discussion of the objective performance claim for the benchmark, best practices and current limitations of the tool. In addition, it is important to note that candidates for each of the benchmarks must have fulfilled the requirements for the prior level benchmark but not necessarily obtained it. The Coordinating Committee of QIN, consisting of the chairs of each of the Network Working Groups and selective NCI QIN program staff, review each benchmark application. If an application for a benchmark is rejected, the applicant will be allowed to address the concerns and resubmit the application.

## **QIN Challenges and Collaborative Projects**

Challenges and Collaborative Projects (CCPs) support QIN tool benchmarks in a unique way with regards to providing a venue for problem solving and initial verification of tool performance. Within the QIN, these activities have proven very useful in guiding the development of QI tools and analytic methods in preparation for more complete clinical validation studies. In this framework, several teams with sufficiently developed tools with similar quantitative measurement functions use a common data source, divided into training and test datasets, to determine and compare task-specific tool performance related to determining or predicting the therapeutic response. CCPs have been conducted at various points along the development pipeline, from basic concept to technical verification and preliminary clinical validation.

The CCP activities highlighted the need to create a method for gauging the degree of development a tool attained at any specific timepoint. This would help to evaluate challenge results when tools with widely different levels of development participated. To gauge the level of development for tools in the QIN, a benchmarking process was developed. A Task Force, comprised of QIN members was charged with the task of developing a system to stratify the level of progress made by teams in their efforts to develop quantitative imaging tools for clinical workflow. In the context of QIN activities, a tool can be a software algorithm, a physical phantom or a digital reference object (DRO) used in the production or analysis of quantitative imaging biomarkers for diagnosis, staging of cancer and for prediction or measurement of response to therapy.

## **QIN-Hub to Support Benchmarks and CCPs**

The QIN-Hub was developed and implemented to support the informatics needs for challenges and collaborative projects; and to provide an information management infrastructure to share documents to further facilitate advancement of QIN tools and methods among QIN Working Groups and Teams. Although the QIN SharePoint will be used mainly as an internal data repository for program management, information store in the system will be utilized for specific tasks to help support QIN-Hub increased usage. The QIN-Hub has been operational for the past year and is the central repository and portal for information concerning challenges and collaborative projects. Provision are being made to further expand its utility to support information manage in the form of a challenge table where participants can access the Hub and acquire knowledge of the results of challenges and facilitate discussion on how to leverage experiences to advance QIN tools and methods development (e.g., workflow). The QIN-Hub could make for an information management system to support benchmarks in the form of a process improvement repository to establish “specific practice” for standard labels that signify the development, validation, and clinical translation of quantitative tools through a 5-tier benchmark system. Part of the information management system capability could incorporate

information capture on the limitation of the tools and additional information to support publication such as scientific goals, methods, requirements for each benchmarking designation, validation and verification information.

## **Clinical Trial Design & Development Working Update**

The clinical trials design and development (CTDD) workgroup has been very active and productive. CTDD efforts have been directed towards a few key areas: increasing outreach to groups outside of QIN, publishing manuscripts describing QIN tools and efforts, and working towards cross-institutional tool validation. Presentations to groups outside of QIN were to members of the National Clinical Trials Network (NCTN) which were well-received at several national meetings, with key highlights including Ella Jones (UCSF) leading a panel at AACR-SNMMI and John Buatti (Iowa) giving a plenary session at NRG-Oncology. These outreach activities are planned to continue in a panel session at ASTRO led by Hui-Kuo Shu and John Buatti and multiple QIN members attending ECOG-ACRIN, in October 2018. The CTDD has also worked to publish several manuscripts: “The Use of Quantitative Imaging in Radiation Oncology: A Quantitative Imaging Network (QIN) Perspective,” was published in the *International Journal of Radiation Oncology, Biology, and Physics*. Another manuscript, “Standards In Reporting Quantitative Imaging: (STIRQI)” is under currently under revision. The CTDD hopes to continue its publishing success in the future. Finally, the group is working to promote cross-institutional validation of QIN tools to facilitate their use in clinical trials. Key examples of this include variance testing of Auto-PERCIIST (Richard Wahl, Washington University) and use of BrICS (Hyunsuk Shim, Emory) in a multi-site clinical trial. The CTDD plans to continue these efforts and more as it continues to work to advocate for the adoption of QIN tools in clinical trials and ultimately into their acceptance in clinical medicine.

## **QIN Publications**

The QIN has a public facing web site that can be accessed via the internet (see link: [https://imaging.cancer.gov/programs\\_resources/specialized\\_initiatives/qin/about/default.htm](https://imaging.cancer.gov/programs_resources/specialized_initiatives/qin/about/default.htm) ). Plans are currently being made to increase the site utility and enhance usability for the membership and cancer imaging research community in general. One of the enhancement activities is to increase current publication title collection by the QIN members in a centralized location for easy public access. The goal is to increase the availability of this information under the publication link on the web site so interested parties can visit the site and access listing for future review and the internet. A recent data call with the QIN membership generated 32 publications from 4 QIN teams. Please stay tuned to learn how program staff will make additional QIN publication available to the readership.

## **New QIN Associate Members**

The QIN would like to welcome 5 new Associate Members: University of Florida Prostate Cancer Transatlantic Consortium, African Collaborative Center for Microbiome and Genomics Research (Nigeria), University of Maryland School of Medicine, Lagos State University Teaching Hospital (Nigeria), and Hampton University Proton Therapy Institute (HBCU affiliation). The QIN Associate Membership is increasing and demonstrates continued interest by the cancer imaging research community in QIN and the collaborative opportunities it provides for adding value to cancer research activities.

## From the QIN Director

Two things are on my mind as I write this. First, the efforts everyone is going through to bring QIN tools into clinical utility has been amazing. Without naming names (you know who you are), the process of engaging the NCTN community continues to be unbelievable. Looking back over the past year, we have entered into a meaningful discussion with ECOG-ACRIN, ALLIANCE, and NRG. SWOG and COG are on our list for the coming year. Several tools have been placed in clinical trials and it looks promising that more will be coming soon.

This progress is a tribute to the QIN investigators and to the power of team networking that is at the foundation of the QIN. I realize that much of the work of which I speak falls into the “unfunded mandate” category. You each have enough to do just making progress on your own research projects, but you have made the time to go above and beyond to bring network goals closer to reality. Those goals include the translation of quantitative imaging tool into clinical utility. I don’t know if any of us had an idea of just how laborious that task would be, and maybe our lack of understanding the difficulty was what kept the network moving forward. In any event, I can say without hesitation that the atmosphere in the network is very different from what it was 5 or 6 years ago. There is an enthusiasm for tool challenges, climbing up the benchmark ladder, and presenting results as a team at scientific meetings.

As we move into the fall and winter seasons, there is momentum building from the presentation I made to the NCI Clinical Trial Advisory Committee (CTAC) last July. We will be making a brief presentation to that group once again at its next scheduled meeting to suggest that a small working group be established to work through issues related to QIN/NCTN interactions. This will give us a regular voice with CTAC to discuss ideas and plan possible activities for translating tools.

The second thought on my mind is our interaction with QIBA. This seems to be a topic that pops up when we plan and hold our annual meeting, then disappears down a rabbit hole not to be seen again for another year. I want to break that cycle and bring it up for discussion. There are many QIN members that also sit on committees for QIBA, and there needs to be a serious dialogue on bringing the two groups with similar goals but different pathways together. Don’t get me wrong, Ed Jackson and I have come a long way toward bringing QIN and QIBA closer than they were a few years ago. I just don’t want the current status of our interactions to be a final resting point for them. We must do more. The upcoming RSNA would be a great opportunity for that. Unfortunately, I will not be attending, so I leave any planning from the QIN side to Dr. Janet Eary and Dr. Paula Jacobs. I am hoping that the dialogue can be continued at RSNA and that we have regular discussion in our upcoming Executive Committee meeting on the topic.