Boston Medical Center shortens MR exams with **PerformanceBridge Protocol Manager**

Boston Medical Center (BMC) implemented Philips PerformanceBridge Protocol Manager to optimize and standardize its MR protocols, with a goal of reducing exam times. Analysis of brain and spine exams shows that use of Protocol Manager for those exams led to:

Decreased exam time

Decreased number of scans per exam

Increased volume

Increased revenue

Boston Medical Center operates a busy MR department, with 40 radiologists and 21 full-time technologists conducting approximately 575-625 studies per week on three MR systems. The department schedules 30 minutes per exam, but long and varied protocols had pushed many exams beyond 30 minutes, wreaking havoc on department scheduling and resulting in undesirable patient waiting times. When Kevin J. Chang, MD was appointed Director of MRI, one of the first requests from radiologists and staff was to wrangle control over runaway exam lengths and bring more consistency to imaging.

"In particular, neuro exams were complex and long, because there were multiple optional, time-intensive pulse sequences, each one often being requested by a different attending physician," Dr. Chang says. "It made the whole process very complicated, because technologists had to look at which referrer was referring which patient, and which sequences they wanted to add – even if it was a routine exam."

Kevin J. Chang, MD
Director of MRI

Jude Ierardi
Manager of MRI

Philips introduced PerformanceBridge Protocol Manager shortly after Kevin J. Chang, MD and Jude Ierardi, Manager of MRI, began to address shortening exams. Protocol Manager allows users to edit protocols off-line and lock in department-approved protocols for a hospital's fleet of Philips MR systems.

Off-line protocol editing avoids clinical schedule disruption

PerformanceBridge Protocol Manager is designed to improve standardization across a fleet of MR systems and save time by managing protocols from a central repository. Authorized users access a browser-based protocol portal on their computers to remotely view protocols, edit more than 400 scan parameters and distribute protocols over connected MR systems. The analytics dashboards help identify opportunities for protocol optimization and standardization, and help users monitor protocol use and performance.

BMC had begun to optimize and limit protocols before using Protocol Manager, but found the process very cumbersome. "If we wanted to edit a protocol before Protocol Manager, we had to schedule it in advance by either finding an unused time slot or blocking off time so we had access to the scanner interface," Dr. Chang explains. "It disrupted our clinical schedule. It was a nightmare trying to schedule time on the scanner to make these protocol changes, much less to test out the protocol changes after the fact. With Protocol Manager, we can edit protocols at any time, without disrupting scanner use."

Since installing
Protocol Manager,
volume has increased by
3 studies per day,
which translates to an additional
$324,000 per year.*

Involvement of all parties is key to protocol selection

Only a small group, consisting of Dr. Chang, Ierardi, and Sara Martin, the department's quality assurance specialist, are authorized to edit protocols. However, all the radiologists and technologists were involved in the selection process. Ierardi names having the radiologists review and agree to the protocols as key to successful implementation of Protocol Manager. She adds that she and Dr. Chang facilitated communication between the radiologists and the technologists, which helped solidify common goals.

The optimization team's first step was ascertaining which exams were ordered most often. To achieve the greatest impact, they prioritized standardization for those exams. "Neuro exams make up 70% of the exams conducted on the Philips scanners, so that became our top priority," Dr. Chang explains. "I'd like to thank Dr. Osamu Sakai, Chief of Neuroradiology, whose dedication to finding ways to decrease neuro exam times without impacting quality was instrumental to the success of this project.

"In every category, we checked how often exams were over the time limit, to determine which protocols needed to be shortened. Then we reviewed those protocols with section radiologists to learn which pulse sequences they thought were least important, or the most redundant. Finally, we marked those specific pulse sequences either for elimination or for acceleration."

Once the new protocols were chosen, they were tested, edited if needed, and made available on the scanners. The standardized protocols are locked in to prevent unauthorized changes.

*Increase in volume can also be attributed to a schedule change that resulted in more efficient scheduling of MR patients requiring anesthesia.
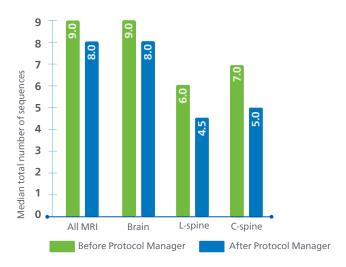
Refresher training increases proficiency and comfort level

Ierardi states that two factors had the most impact on exam length: the number of sequences and the choice of sequences. Technologists often chose sequences that they were most familiar with, rather than using more recently developed options. For example, incorporating Philips Compressed SENSE and mDIXON in protocols helped shorten exam time while also reducing artifacts.

"Sometimes the newer technologists weren't using Compressed SENSE as they should. So they would re-run sequences, and it was really lengthening our scan time," Ierardi notes. To remedy this problem, Ierardi instituted refresher training to help the technologists feel more comfortable with newer sequences and acceleration techniques.
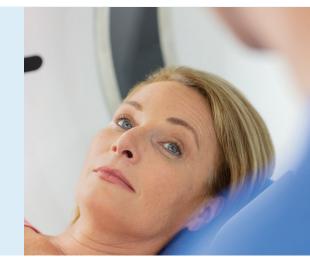
"The techs were retrained on Philips applications on two occasions, and the more seasoned technologists also worked with the radiologists to decide which sequences to include. The techs are extremely talented, some of the best in the city, and when they were able to collaborate with the radiologists toward better image quality and time savings it was much more engaging and strengthened the overall team."

Median number of sequences

Median total number of sequences

	All MRI	Brain	L-spine	C-spine
Before Protocol Manager	9.0	9.0	6.0	7.0
After Protocol Manager	8.0	8.0	4.5	5.0

Before Protocol Manager
After Protocol Manager

Median total sequence time for MR spine exams

Median total sequence time

L-spine
Before Protocol Manager	After Protocol Manager
19.4	16.7

C-spine
Before Protocol Manager	After Protocol Manager
23.0	15.0

T-spine
Before Protocol Manager	After Protocol Manager
44.2	40.6

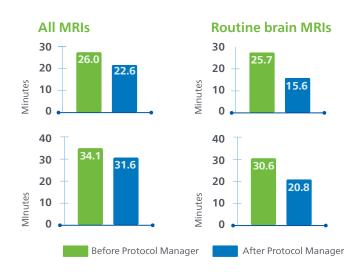Before Protocol Manager
After Protocol Manager

Brain studies shortened by 10 minutes

After three months with Protocol Manager, work is ongoing, but the results are already clear. Sequence time has dropped by nearly 10 minutes for brain studies, and 3.4 minutes for all exams. L-spine and T-spine studies have decreased by 3 minutes and C-spine studies have decreased by 8 minutes.

In addition, volume has increased by three studies per day, which translates to an additional $324,000 per year. While some of the volume increase may be a result of bounce-back to pre-COVID levels, the volume increase was measured between February and April, after elective exams volume had begun to return.*

Chang points out that, because at least one sequence was eliminated from all routine spine and brain exams, the new protocols also shortened reading time, adding to the workflow efficiency.

Median exam times of Protocol Manager

All MRIs
Minutes

Before Protocol Manager	After Protocol Manager
26.0	22.6
34.1	31.6

Routine brain MRIs
Minutes

Before Protocol Manager	After Protocol Manager
25.7	15.6
30.6	20.8

Before Protocol Manager
After Protocol Manager

*Increase in volume can also be attributed to a schedule change that resulted in more efficient scheduling of MR patients requiring anesthesia.

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>
> **– Kevin J. Chang, MD, Director of MRI**

Shorter exams reduce artifacts in abdominal studies

Dr. Chang and Ierardi both note that while the goal was shortened exams, the new protocols do not sacrifice image quality, and often improve it.

"Our goal is for the referrers to not notice any protocol changes, except to be pleasantly surprised by improvements in image quality. For abdominal imaging, the referrers definitely noticed that the image quality has gotten better and that more patients are able to get through the scans as well, with fewer breathing artifacts," says Dr. Chang, who specializes in body imaging. "One of the biggest advantages of pulse sequence acceleration in abdominal imaging is that it reduces respiratory motion artifacts."

Consistent imaging supports teaching

Locking in exams also improved consistency. "Before we standardized protocols, I may have had some technologists who always obtained stellar images, but it wasn't consistent among technologists, and it certainly wasn't consistent between the scanners," Ierardi explains.

Chang, who is also an associate professor of radiology at Boston University School of Medicine and adjunct associate professor at Brown University Alpert Medical School, adds that consistency is particularly important because BMC is a teaching hospital.

"MRI is one of the most daunting modalities to learn during residency and fellowship education, mostly because of the sheer number of pulse sequences involved," he says. "The more consistent the protocols are, the easier it is for residents and fellows to interpret a scan. And oftentimes the more complex a protocol is, the less apparent it is to a resident or a fellow when the protocol hasn't been done correctly, or when there's a missing pulse sequence."

Supports hospital's mission

Implementing Protocol Manager also serves a larger patient goal. "Many of our patients have limited access to healthcare, and an MRI appointment can be difficult to get, because we have only three scanners for this large population," Dr. Chang points out.

"Shortening scan times and improving workflow efficiency increases access to MRI for patients who otherwise may not have been able to get an exam in a timely fashion. I think all patients should have equal access to the imaging services that they need for their clinical care, regardless of their insurance status, and regardless of their ability to pay. So anything I can do to shorten the time from scheduling to examination, and to increase the number of patients that can get scans in order to get timely medical care, the better. And I think that's what serves our hospital's mission to the city of Boston."

Results from customer experiences are not predictive of results in other cases. Results in other cases may vary.

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