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Experience Solutions

MRI Efficiency Paper

Realizing **productivity** **gains** in MRI

Focusing more on the patient can boost the efficiency of MRI procedures

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Background and overview

suAzio Consulting* carried out a survey in December 2017 on MRI suite efficiency; 16 radiologists and radiographers were interviewed in the US, as well as 24 elsewhere (8 in Germany/Austria/Switzerland, 8 in the Middle East and eight in the UK). These 40 specialists worked on a total of 98 MRI scanners. Siemens was the most common brand, followed by Philips and GE. Each MRI unit carried out an average of approximately 90 scans per week. Head & neck, spine, knee and abdominal were the most common areas scanned.

Overall, the radiologists and radiographers interviewed reported a relatively high degree of contentment with the efficiency of MRI procedures at their hospitals or imaging centers. The average reported satisfaction rating was 4 out of 5.

However – and somewhat paradoxically – the interviewees also reported considerable issues with efficiency. The main problems were identified as follows:

- **1 in 14 scans** could not be performed because of patient anxiety
- **1 in 20 scans** were aborted – patient motion was the cause in 58% of the aborted scans
- Approximately **1 in 5 scans** required a rescan because of patient motion
- Patients not showing up on time

Where there was dissatisfaction, the main contributing factors were, in order of importance:

- MRI equipment
- Slowness of scan
- Patient factors

There is therefore a gap between the general satisfaction levels of interviewees (4 on a scale of 5) and the actual efficiency statistics, which indicated that, for example, 20% of all scan sequences required a rescan. It would seem that there is room for improvement.

One explanation for this discrepancy is that the root causes of scans not being performed, being aborted or requiring a rescan often lie with the patients themselves, and are therefore regarded by specialists as inherent to imaging and therefore accepted. This is backed up by the fact that 45% of interviewees said they were not familiar with potential ways of increasing patient compliance, reducing retakes/rescans or minimizing patient motion.

This paper examines some root causes of MRI procedural inefficiency in detail, and proposes that – through putting greater emphasis on the patient during MRI procedures – it is possible to increase efficiency. In other words, the root causes of unsatisfactory scans do not have to be considered as just unavoidable, and can be actively addressed.

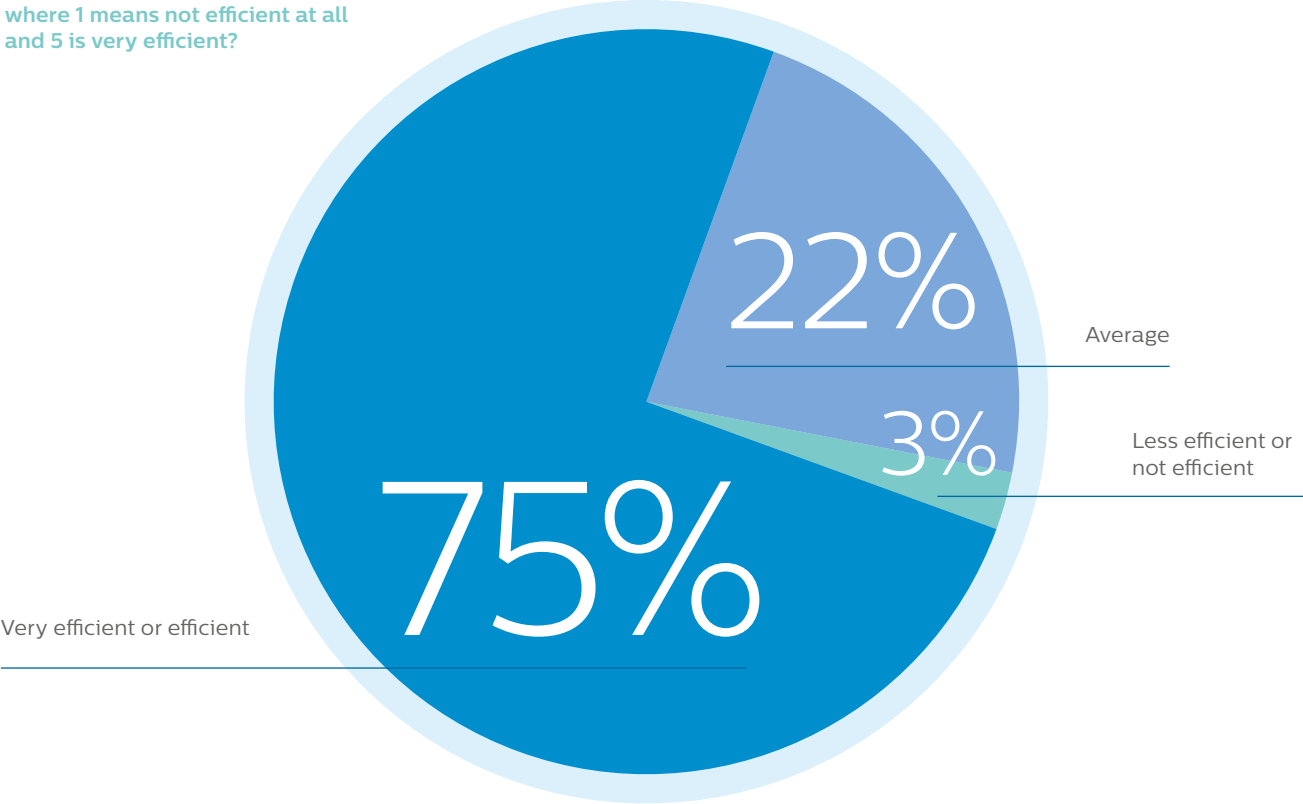
*suAzio Consulting is an independent, international marketing boutique consultancy firm specializing in the life sciences and pharmaceutical industries. Philips Healthcare Experience Solutions commissioned the study, but played no further role in the research or results.

Note: results and statistics mentioned in this paper are from the suAzio study, unless otherwise stated.

How satisfied are MR specialists with their scanning procedures?

One of the first aims of the survey was to establish how efficient radiographers and radiologists think their current MRI procedures are. They were therefore asked the question:

How would you rate your MRI suite's efficiency on a scale from 1 to 5, where 1 means not efficient at all and 5 is very efficient?



The main reasons specialists gave a positive score was, in order of importance:

- Process efficiency
- Scheduling
- Image quality
- MRI equipment
- Protocols
- Process speed



Where there was dissatisfaction, the main contributing factors were, in order of importance:

- MRI equipment
- Slowness of scan
- Patient factors



“There is a **small interval between appointments** and a high scan usage rate of 80% (20% is for the patient and cleaning up).”

Radiologist, Germany/Austria/Switzerland region.

“We have two technologists and we run two rooms. We control our schedule and that is why it is efficient.”

Radiographer, USA Technologist,

“Efficiency is good, not excellent. **The workflow of technologists and the transportation of patients** could be better.”

Radiologist, USA.

“We have a whole confirmation process, and if patients don’t confirm the appointment it causes an issue – and empty time on the scanner.”

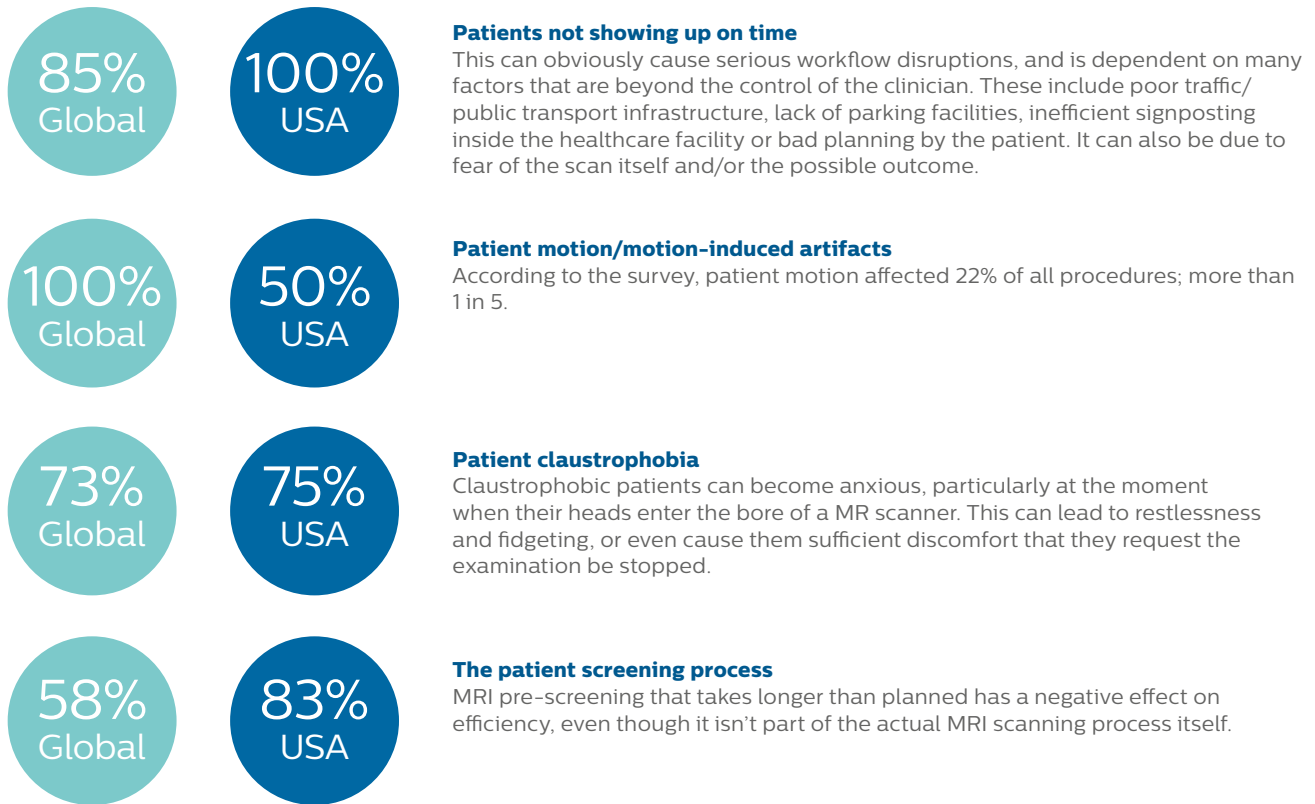
Radiologist, USA.

The paper aims to show how efficiency gains can be made through implementing a stronger patient focus and involving the patient more in the examination process. This has particular relevance to points 2 and 3.

Factors contributing to inefficiency



When asked for the top three challenges impacting MRI efficiency, the most frequently-reported root causes in the survey were:



The three main clinical consequences of patient motion reported, are:

74%

Decrease in image quality (cases in which there was patient motion)



70%

The possibility of an exam not being suitable for diagnostic purposes



55%

An increase in the time required to carry out the scan



The impact of the patient on efficiency

Going one level deeper, the reason for patient motion most frequently mentioned in the study was anxiety. This was reported to cause patient motion almost twice as often as pain or claustrophobia. 28% of all patients undergoing MRI scans were said to suffer from anxiety.

33%

of respondents perceived patient motion and claustrophobia as major challenges.

25%

of all patients and scans are affected by anxiety. Anxiety was identified as the leading cause of patient motion.

60%

of scan abortions are due to patient motion, especially head-first scans which are also the most commonly-performed type. Patient motion is most common among elderly patients and children

20%

of all MRI scans need to be re-done completely.

“When patients are not comfortable, they demand a lot. Sometimes they want to get taken out of the machine.”

Radiologist, USA.

Case study:

University of Washington School of Medicine, USA

In an investigation by Dr. Jalal B. Andre, a total of 192 completed clinical examinations were reviewed. Significant motion artifacts were identified on sequences in 7.5% of outpatient and 29.4% of inpatient and/or emergency department MR examinations. The prevalence of repeat sequences was 19.8% of total MRI examinations. The base-case cost estimate yielded a potential cost to the hospital of \$592 per hour in lost revenue due to motion artifacts. Potential institutional average costs borne (revenue forgone) of approximately \$115,000 per scanner per year may affect

hospitals, owing to motion artifacts (univariate sensitivity analysis suggested a lower bound of \$92,600, and an upper bound of \$139,000).

Conclusion:

Motion artifacts represent a frequent cause of MR image degradation, particularly for inpatient and emergency department patients, resulting in substantial costs to the radiology department. Greater attention and resources should be directed toward providing practical solutions to this dilemma.



As mentioned already, **20%** (1 in 5) of all MRI scans have to be carried out again because of patient motion. This has a major impact on the departmental efficiency. According to the suAzio study results:

53%

of interviewees said that waiting times increased as a result of these retakes and rescans

35%

said that patient throughput decreased

50%

said that revenue was negatively impacted

The impact of the patient on inefficiency



The main actions to reduce the number of retakes were:

- Sedation and medication (55% of interviewees said they did this)
- Guiding the patient before and during the process (28% of interviewees said they did this)

Sedation* and medication**

Clinicians were asked the following questions on this topic:

- **Of the total number of MRI scans you perform, what percentage requires patient sedation?**
- **What are the main reasons patients need to be sedated?**

Regarding the percentage, answers varied from 0 to 60%. Only two of the 40 specialists interviewed said that they never have to sedate. The average across all respondents was 13%, which means that approximately one in eight patients have to be sedated before undergoing an MRI exam.

The most commonly-mentioned reasons for having to sedate or medicate were pain, anxiety, claustrophobia and motion. Children and elderly patients were more likely to be sedated than patients of other ages.

Reducing the need for anesthesia or sedation can shorten the length of a patient's hospital visit¹, reduce costs² and cut wait times. In particular the sedation of children should be avoided whenever possible, because it may have long-lasting effects on their neural development³.

Guiding patients through the process

The majority of respondents said that they prepare patients who are about to undergo an MRI scan. This generally involves explaining what is going to happen to try and reassure them. In some cases brochures and videos are used to demonstrate the procedure.

During the scan various techniques are employed. These include ongoing communication using a microphone/loudspeaker, having patients wear eye shields or giving them squeeze balls, using a vapor rub to provide aromatic distraction or listening to music. Immobilization – essentially preventing the patient from moving using strapping or padding – is another option.

“We often let [patients] lay down into the scanner to see if they can handle it. We show them that we will be able to see them all the time, and they are not alone.”

Radiographer, USA.

“The **more time** you **spend with patients** to comfort them before they go in, the **less chance** you have of **failure or motion**. We ask the patient to come in at least 35 min before their scheduled time.”

Radiologist, USA.

* Sedation: the act of calming by administering a sedative. A sedative commonly induces the nervous system to calm down.

** Medication: a drug or other substance that is used as a medicine (e.g. pain killers).

¹ Lemaire et al., Journal of Magnetic Resonance Imaging, Volume 30 Issue 3 (September 2009). <https://onlinelibrary.wiley.com/doi/full/10.1002/jmri.21870>

² Vanderby et al., Radiology, Volume 256 Number 1 (July 2010). <https://pubs.rsna.org/doi/abs/10.1148/radiol.10091124>

³ Glatz et al., Journal of Magnetic Resonance Imaging, Volume 171 Issue 1 (January 2017). <https://jamanetwork.com/journals/jamapediatrics/fullarticle/2580308>

Awareness of solutions that can increase efficiency

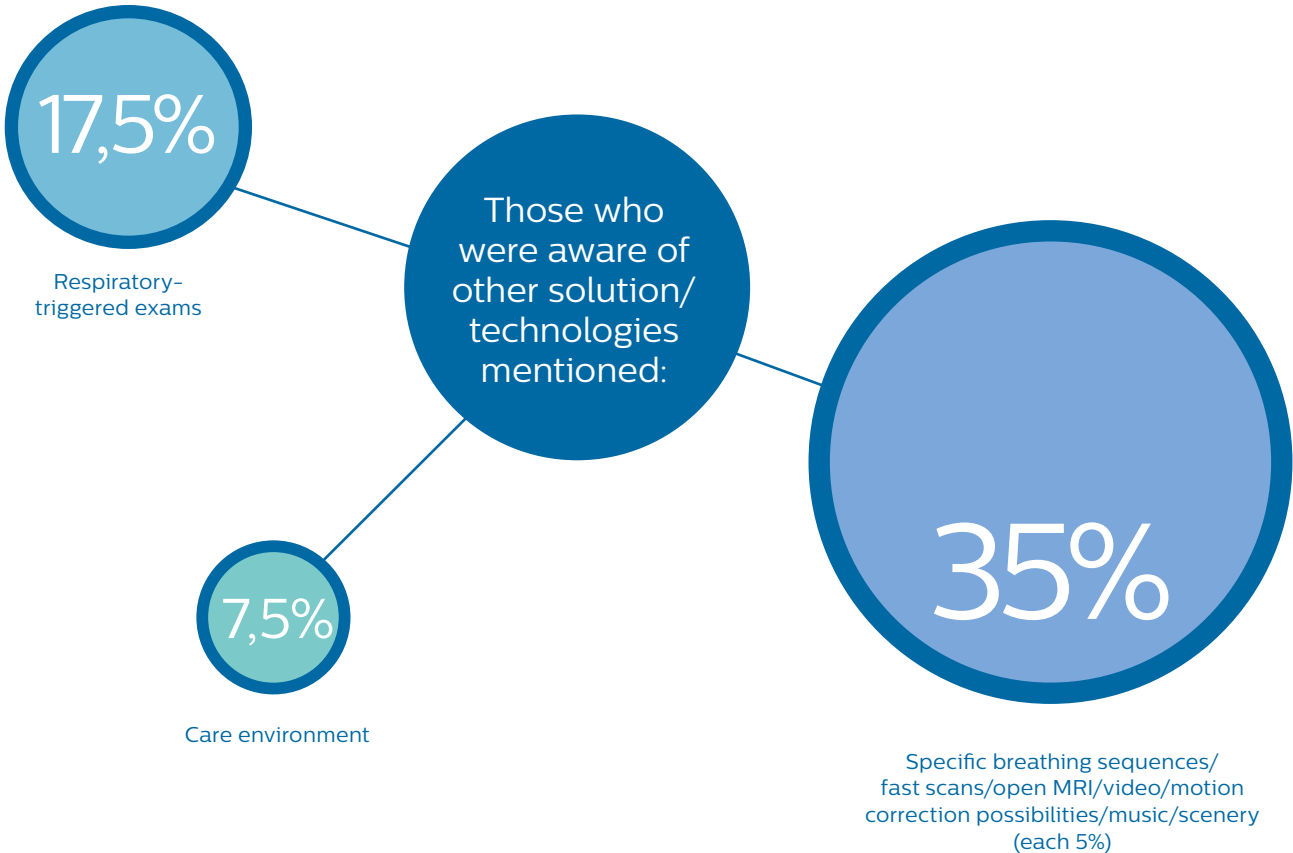
The previous sections have demonstrated that many radiologists and radiographers are aware of inefficiencies in MRI procedures. It's also clear that the majority of hospitals and imaging centers already take measures to reduce these inefficiencies; of which sedation and medication are the most the most common.

It's therefore interesting to realize that a high proportion of those interviewed were unaware that, in addition to sedation, medication, education and explanation, there are other technologies and solutions available which can improve MRI procedural efficiency.

Are you aware of any existing solutions/technologies addressing the efficiency issues already discussed?

17 out of the **40** respondents (42.5%) answered 'no' to the question:

The percentage was much higher in the US; **62.5%** were unaware.



Probably the most important change required to increase efficiency of MRI procedures is the role of the patient. At the moment, patients are not really expected to contribute to the process. Essentially, hospitals work around them instead of with them.

In other studies such as Becker's Hospital Review neatly encapsulated this need for change in October 2016, saying; "together, we must help patients transition from the most underutilized resource in healthcare to become an organization's biggest asset."

Studies have shown that a positive patient experience is associated with clinical effectiveness and patient safety. In other words, by focusing on the patient it becomes possible to support radiology's primary function of acquiring images that lead to a confident diagnosis and treatment plan.

"I don't know [of any solution/ technologies for increasing patient compliance]."

Radiologist, US.

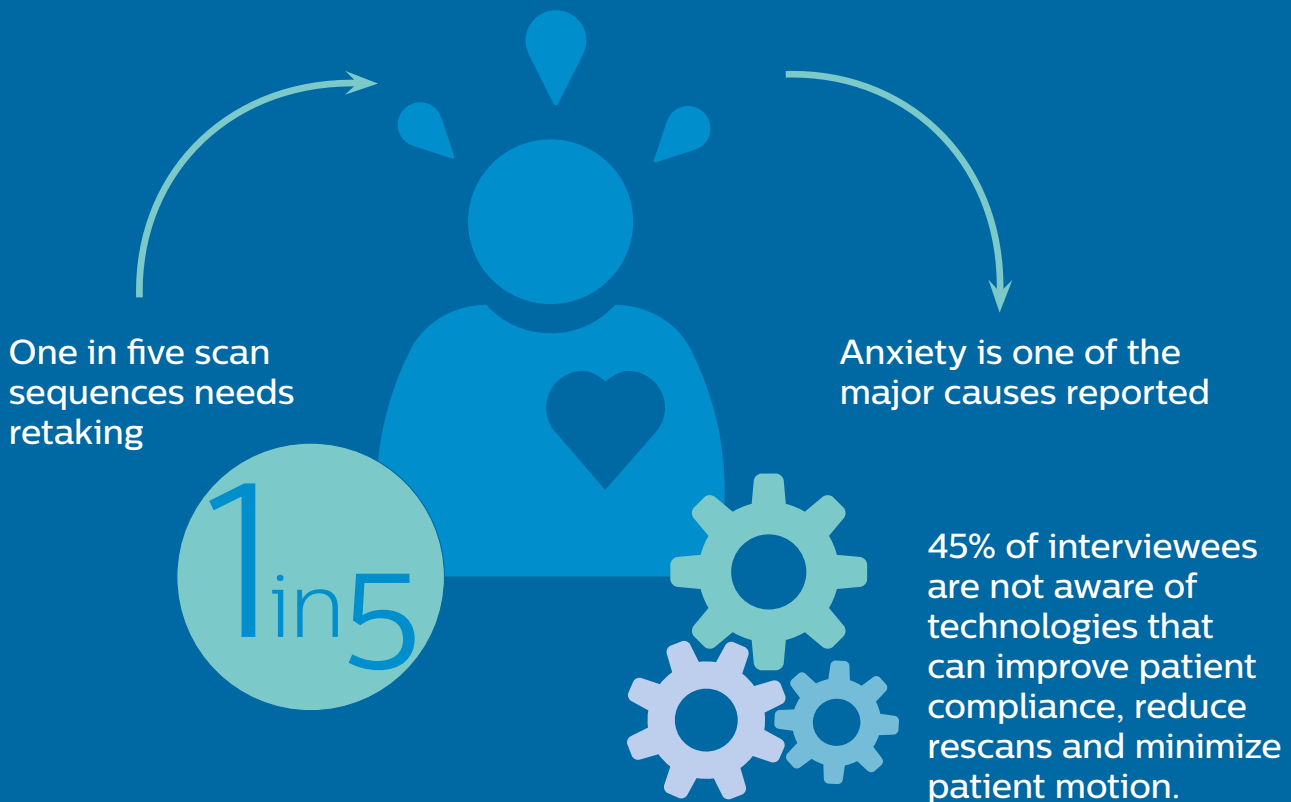
"Open MR lets patients look outside the machine, but it has limitations because then their head is tilted."

MRI Radiographer, US.

Realizing productivity gains during MRI scans by focusing more on the patient

A global MRI efficiency study reveals blind spot

While virtually all respondents considered themselves efficient or better (the average rating was 4 out of 5), the same group also reported major issues



Supporting and involving patients during the entire exam process

One way of supporting and involving patients is to explain to them beforehand what is going to happen and, in doing so, reduce or even eliminate some of the stress they may have. Another approach is to have a mock scanner, which helps prepare them for the examination. This is especially suitable for children. In some cases they can even 'scan' toy animals which contain an RFID tag. When a child places one of the toys in the mock scanner, an animation activates on a nearby screen which tells the story of that particular character and mimics the results of a scan.⁴

Specific patient-oriented innovations, such as a Philips Ambient Experience in-bore solution for MR, was reported to have reduced the number of rescans required at Herlev hospital⁵. Engaging visuals are displayed on a screen, and can be seen via a mirror strategically positioned on the head coil. Patients can also listen to music/sound through the headphone.

The combination of visual experience, comforting guidance and reduced noise may help increase satisfaction and compliance. From the moment a patient is moved into the scanner (the point at which they report the most stress) through to completion of the scan, Ambient Experience in-bore Connect encourages them to relax, follow directions and remain as motionless as possible.

It is also possible to turn exam rooms into environments designed to offer a multi-sensorial experience that calms those undergoing imaging studies. When patients enter these rooms they should feel reassured and welcomed, and have the impression that they are being taken care of in a personalized way. Dynamic elements, both visual and audio, provide positive and active distraction, as well as procedural guidance. The interactive nature of these environments gives them a sense of control, and allows them to actively participate in their care environment.

Supporting the patient while in the bore

The in-bore solution supports patients during an MRI examination by visually counting down how long they need to hold their breath and displaying a progress bar. Both Herlev Hospital and Chiba Hospital report that with the in-bore Connect it is significantly easier for patients to hold their breath.

Additionally, a visual progress bar led to 84% of patients claimed they felt calmer during their MRI examination*, and patients were overall more likely to recommend the examination to a friend.

“As healthcare professionals, we have an obligation to look at the whole patient, not just the images. We must consider the entire experience, and I believe every patient deserves a positive one.”

Peter W. Curatolo, Radiologist, Beverly Hospital (USA)



* Results from case studies are not predictive of results in other cases. Results in other cases may vary.

References:

⁴ <https://www.90yearsofdesign.philips.com/article/30>

⁵ <https://www.usa.philips.com/healthcare/education-resources/publications/fieldstrength/mri-patient-experience-to-help-reduce-motion>

Addressing patient timeliness and no-shows

Consultants from Philips, a global leader in healthcare technology, describe how a number of measures can be taken to increase the possibility that patients show up, and that they arrive on time.

Providing correct pre-procedure information

It generally helps when the imaging department itself – rather than the ordering physician's office – takes care of the pre-procedure phone calls, which usually take place 1-2 days before a scheduled exam. In these calls, patients are instructed on:

- arrival practices – e.g. wayfinding details like where to park and where to register
- timings – i.e. that they should arrive approximately 15 minutes before their appointment
- location – how to find the MR department
- any necessary preparation (see below) or lab work
- expectations – many patients don't like the idea of being positioned inside the magnet, so education is very important. They can be told about pre-medications as well as mirrors that trick the brain into thinking they aren't in a narrow tube.

Preparing the patient for the MR exam

There are very strict guidelines that must be followed to ensure the safety of the MR exam. Many patients do not meet the criteria, so once again it is important that the imaging department is in direct contact with the patient so all issues (e.g. metal implants) are identified and taken into consideration.

Involving the radiologists

MR scheduling is complex; there are many different procedures to choose from, and multiple variations within each one. Having the radiologists review and define the required imaging 'protocol' the day prior to an exam helps expedite the flow.

Involving the insurers

Many MR exams require precertification by the insurance payor (due to the cost associated with them). This can take several weeks, so most MR departments schedule exams a few weeks in advance to make sure this does not become a potential bottleneck.

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Case study:

Children's Hospital of Georgia, USA

The Children's Hospital of Georgia (CHOG) at Augusta University Health redesigned its pediatric radiology suite using a family- and patient-centered approach. This included an interactive video wall in the waiting room, multi-sensorial installations in the imaging suites, plus a miniature, mock scanner that allows young patients to simulate CT exams using toys as patients. As a result, CT scans were up by 11%; MRI by 33%; Ultrasound and vascular by 29% and vascular IR by 39%. While several pieces of existing equipment were upgraded or replaced, there was no net increase in the number of imaging devices. During this time, the number of radiologists decreased by 2.5 FTE.⁶

Case study:

Herlev Hospital, Denmark

Under the direction of Michel Christian Nèmery, chairman of the radiology department, Herlev added the Philips MR Patient In-bore Solution to its Ingenia 3.0T system. The audiovisual in-bore experience measurably improved their patients' MRI experience, helping reduce patient motion and increase efficiency. Based on a patient survey reported by Dr. Nèmery, 90% of patients reported having a 'better' or 'much better' level of comfort with the patient in-bore solution.⁷ Herlev also reported a 70% reduction in rescans as a result of implementing this patient-centric technology^{*8}.



References:

⁶ Reported by Dr James Rawson,

Chief of Radiology at Augusta University Health, April 2015.

⁷ <https://www.usa.philips.com/healthcare/education-resources/publications/fieldstrength/patient-comfort-leads-to-first-time-right-imaging>

⁸ <https://www.usa.philips.com/healthcare/education-resources/publications/fieldstrength/patient-comfort-leads-to-first-time-right-imaging>



The way forward in MRI productivity

The root causes of MRI procedural inefficiency, which can lead to 20% of all scans being inadequate, should not be accepted or countered with sedation. Philips has examples of better and more efficient ways of dealing with stress and motion.

Studies have shown that a positive patient experience is associated with clinical effectiveness. Patients who feel comfortable and secure make it easier for staff to acquire high-quality images. In particular, multi-sensorial exam room environments with dynamic lighting, projection and sound provide positive and active distraction, as well as procedural guidance, for patients.

The Herlev Hospital in Denmark reported a 70% reduction in rescans as a result of implementing a patient-centric technology featuring an audiovisual in-bore experience .

Such solutions may meet the expected growing desire of patients to play a positive and more active role in their diagnosis and treatment. Hospitals and diagnostic centers should bear this in mind when investing in equipment like MR scanners, now and in the future.

