Magnetic Resonance Imaging (MRI) Systems

MRI systems use strong magnetic fields and radio-frequency (RF) radiation to translate the distribution of hydrogen nuclei in body tissue into computer-generated images of anatomic structures. Magnetic resonance images have excellent soft tissue contrast allowing clinicians to distinguish between normal and abnormal tissue, and patients are not exposed to any ionizing radiation during the procedure. MRI systems can currently be grouped into 3 general categories based on magnetic field strength: 3T scanners, 1.5T scanners, and low-field (1.2T or less) scanners.

Which MRI system vendors and models should your facility consider?

ECRI Institute’s SELECTplus™ User Experience Network (UEN) is one of many tools available from ECRI to help supply chain leaders make informed purchasing decisions. The SELECTplus UEN recently polled hundreds of MRI system users on a variety of criteria including Image Quality, Ease of Use, Patient Throughput, System Reliability, Service, and Vendor Support. The survey results show user satisfaction ratings by vendor and model, along with feature comparisons, member interest (market share), and average quoted pricing based on actual vendor proposals submitted by hospitals. A brief excerpt of the full UEN report (available exclusively to SELECTplus, Health Devices System, and Health Devices Gold members) is provided below.

Key Survey Findings:

- MRI models with the highest overall user rating scored highest in **Ease of Use** and **Image Quality**.
- MRI models with the lowest overall user rating scored lowest in **Reliability** and **Vendor Service**.
- On a scale of 1 to 5 (5 being best), the average user rating for **Image Quality** across all 3T MRI systems was 4.3 compared to 4.2 for all 1.5T MRI systems.
- According to survey respondents, some 1.5T MRI models had an identical or higher **Image Quality** rating compared to their counterpart 3T MRI models within the same vendor’s product line.

Analytics and Research to Support the Survey Results

ECRI Institute analysts and technology experts aggregated cost, configuration, service contract, and performance data based on the survey results and our research, deriving the following analytics and key takeaways:

#### Key Players

GE, Philips, Siemens, and Toshiba dominate the marketplace. **Price metrics** for some of the most popular 1.5T MRI systems are shown.

![Average List and Quoted Prices for 1.5T MRI Systems](chart)

**SELECTplus™** market data charts are based solely on price points submitted to ECRI Institute in a 12-month period by members of the SELECTplus™ advisory service, as of April 2014. This data is not validated market share data, and does not reflect information about manufacturers of MRI systems from which we have not received any data. The data provided is time sensitive and may not be accurate at a future date.
**Image Quality**

Survey results show user ratings for MRI Image Quality by Vendor and Magnet Strength.

Additional survey results, including ease of use, coil selection, patient comfort, throughput, user training, and vendor support for 9 of the latest models currently in production in the US are available to SELECTplus members by logging on to the SELECTplus, Health Devices System, or Health Devices Gold member website at www.ecri.org.

**Feature Matching**

The current generation of 1.5T MRI systems all have wide short bores and noise reduction technology to improve patient comfort. To further address patient anxiety, some systems allow for feet-first imaging and some vendors offer ambient room lighting and sound, as well as the projection of calming images on to the wall or ceiling.

**Advanced MRI Acquisition Techniques**

Our survey results indicate that SELECTplus member facilities routinely use cardiac MR and contrast-free MRA techniques. These advanced applications are optional on higher-end 1.5T models. The most advanced applications such as functional imaging, diffusion weighted imaging, and spectroscopy typically require a 3T model.

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**Checklist for MRI System Acquisition**

- **Ease of Use** – Straight forward, consistent setup procedures improve compliance and reduce errors.
- **Reliability** – Get commitments on how uptime will be kept as close to 100% as possible.
- **Workflow** – Features that automate or reduce the number of steps can result in time savings.
- **Siting Requirements** – Spec out minimum room size, fringe magnetic field size, and weight of the magnet.
- **Cost** – Consider capital cost, annual service fee, computer and software upgrades, and consumables.
- **Service and Support** – Negotiate for long term service commitments and guaranteed response times.
- **Training** – Clinical applications training, both basic and specialized, is essential to realize full benefits.

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**IMAGE QUALITY**

Average User Rating by Vendor and Magnet Strength

<table>
<thead>
<tr>
<th>Model</th>
<th>GE</th>
<th>Philips</th>
<th>Siemens</th>
<th>Toshiba</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnet Strength</td>
<td>1.5T</td>
<td>1.5T</td>
<td>1.5T</td>
<td>1.5T</td>
</tr>
<tr>
<td>Field of View (FOV), cm</td>
<td>50 x 50 x 50</td>
<td>55 x 55 x 55</td>
<td>50 x 50 x 45</td>
<td>55 x 55 x 50</td>
</tr>
<tr>
<td>Bore Diameter, cm</td>
<td>70</td>
<td>70</td>
<td>70</td>
<td>71</td>
</tr>
<tr>
<td>Bore Length w/Covers, cm</td>
<td>Not specified, (145 magnet only)</td>
<td>150</td>
<td>145</td>
<td>154.5</td>
</tr>
<tr>
<td>Gradient Strength, mT/m</td>
<td>34</td>
<td>33</td>
<td>33</td>
<td>34</td>
</tr>
<tr>
<td>Feet-First Imaging</td>
<td>All scans</td>
<td>Some scans</td>
<td>Some scans</td>
<td>Most below neck</td>
</tr>
<tr>
<td>Acoustic Noise Reduction</td>
<td>Silent Scan</td>
<td>SENSE</td>
<td>Quiet Suite</td>
<td>Pianissimo</td>
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<td>Coil Technology</td>
<td>GEM</td>
<td>dStream</td>
<td>Tim 4G</td>
<td>Atlas</td>
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<tr>
<td>Functional MRI</td>
<td>BrainWave</td>
<td>Elite Neuro</td>
<td>syngo.MR Neuro</td>
<td>M-Power</td>
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<tr>
<td>Motion Correction</td>
<td>Propeller</td>
<td>MultiVane</td>
<td>syngo BLADE</td>
<td>JET</td>
</tr>
<tr>
<td>Parallel Imaging</td>
<td>ASSET/ARC</td>
<td>dS SENSE</td>
<td>iPAT</td>
<td>SPEEDER</td>
</tr>
</tbody>
</table>

*Not enough survey data available for Toshiba 3T MRI system.*

**SELECTplus**, the nation’s leading healthcare technology procurement advisory service, assists hospitals and health systems worldwide with the safe, cost-effective acquisition of capital medical equipment and health information technologies.

For more information, visit www.ecri.org/select; contact us at selectplus@ecri.org or call (610) 825-6000, ext. 5287.