FMVantage Point™
HealthCare Appraisers' Industry Insight

2023 OUTLOOK FOR MEDICAL DIAGNOSTIC IMAGING EQUIPMENT: APPRAISAL CONSIDERATIONS WHEN DETERMINING FAIR MARKET VALUE OF AN MRI MACHINE

CIARA A. KERNEY, KIRSTEN HODGES, ASA, AND JEFF DOYLE, ASA

WHAT IS MAGNETIC RESONANCE IMAGING ("MRI")?

Magnetic resonance imaging (*i.e.*, MRI) is a non-invasive medical imaging technique used to produce comprehensive anatomical images utilizing a magnetic field and computer-generated radio waves. MRI scans can generate detailed images of nearly all internal anatomical structures, including bones, muscles, organs, soft tissues, and blood vessels. Today, MRIs are deployed by healthcare providers throughout the patient care cycle, beginning with disease detection and continuing with ongoing patient monitoring after treatment. Unlike x-ray technology, MRI machines do not produce radiation and, therefore, are often the preferred test of choice for patients requiring frequent imaging.

HISTORY OF MRI MACHINES

Prior to the development of magnetic resonance imaging came nuclear magnetic resonance ("NMR"). NMR was developed in 1937 by Columbia University physics professor Isidor Rabi as a method of measuring the movement of atomic nuclei in the study of chemical substances. Building upon Rabi's work, American physician Raymond Damadian concluded that cancerous cells contained more water than healthy cells. Dr. Damadian posited that cancer cells could be detected by scanners that immersed a part of the human body in radio waves and subsequently measured the emissions from hydrogen atoms. Based on his theory, Damadian went to work building a human-sized scanner to further test this approach.

As Dr. Damadian proceeded with his work, chemist Paul Lauterbur, who had found a way to use NMR technology to create images, applied knowledge from his own work to human anatomy. Lauterbur realized that a gradient magnetic field allowing observers to take two-dimensional images of an object could potentially be utilized to create three-dimensional images. Lauterbur went on to create the first magnetic resonance image – one of two water-filled test tubes - in 1971. Meanwhile, the work of physicist Peter Mansfield led to the first successful human anatomical scan utilizing a new "line scan imaging" technique using NMR.

In 1977, Damadian, credited as the first physician to leverage NMR technology, ultimately created the first whole-body human scanner, which was dubbed the Indomitable. Damadian founded an MRI manufacturing company called FONAR Corporation in 1978, and FONAR brought the first commercial MRI scanners to market in 1980. Damadian's device was approved by The Food and Drug Administration ("FDA") in 1984 and coverage of MRI scans under Medicare was approved in 1985. Peter Mansfield went on to develop the echo-planar imaging technique, a technique using a single nuclear spin excitation per image and still

utilized today to reduce MRI scan times. With the scientific contributions of Damadian, Lauterbur, and Mansfield, MRI machines became widely available in the 1980's and persist as one of the most prevalent diagnostic tools in medicine.

CURRENT TECHNOLOGY AND LEADING MANUFACTURERS

MRI machines can come in various forms (*e.g.*, open bore, upright, mobile), and are often differentiated by their magnetic field strength. A tesla - denoted as "T" - is the unit of measurement used to define the strength of a magnetic field such as that seen in MRI scanners. The healthcare industry currently utilizes MRI machines ranging from 0.55T up to 7.0T. While 1.0T, 1.5T, and 3.0T scanners are fairly common across the industry, lower tesla machines (*i.e.*, 0.55T) are often used within the clinical workflows of specialties like pulmonology and medical cardiology, and higher tesla machines (*i.e.*, 7.0T) are currently utilized in highly specialized work, including clinical and research-based neurology.

One of the lowest tesla MRI machines currently available on the market is the Siemens Healthineers 0.55T MAGNETOM Free.Max. The MAGNETOM Free.Max received approval from the FDA in July 2021 and positioned itself to break barriers as one of the smallest and most lightweight options with the largest bore (*i.e.*, the circular patient opening) on the market. With its smaller size, quieter operation, and infrastructure lite nature, the MAGNETOM Free.Max has opened the doors to explore new clinical siting opportunities for MRI machines, and allows for the use of whole-body MRI scanning in outpatient centers, emergency rooms, and intensive care units.

The Philips Ingenia Ambition 1.5T is one of three of Philips Healthcare's current 1.5T MRI offerings. While MRI machines have historically required liquid helium to cool their superconductive magnet coils, the Ingenia Ambition 1.5T recently emerged as the first helium-free MRI. The technological advances inherent within a helium-free system promise more predictable operations and greater efficiencies without the potential for helium related complications or concerns of reliance on a non-renewable resource.

With initial approval of the first 7.0T MRI in 2017, GE HealthCare's SIGNA™ 7.0T is now one of many 7.0T MRI scanners available on the commercial market. These powerful MRI scanners are utilized by healthcare professionals in advanced clinical and research settings for highly technical neurological and musculoskeletal imaging. The advanced imaging produced by 7.0T scanners is commonly utilized by researchers in the study of neurodegenerative diseases, such as Parkinson's disease, to visualize alterations in the neurological field of view.

FUTURE TECHNOLOGY

Perhaps the greatest breakthrough in MRI technology in recent years was the introduction of the Magnetic Resonance Imaging Guided Linear Accelerator (the "MRI-LINAC"). As discussed in HealthCare Appraisers' publication, a linear accelerator ("LINAC") is a technically advanced medical system utilized in the delivery of radiation treatment for cancer patients. Combining the treatment capabilities of a LINAC with the imaging capabilities of an MRI machine allows for the delivery of highly personalized treatment plans which can be monitored and adjusted in real time. The MRI-LINAC enables healthcare professionals to ensure greater accuracy in the deployment of radiation treatment by detecting even the smallest shifts in internal anatomical positioning and adjusting accordingly. The increased accuracy afforded by the MRI-LINAC reduces radiation exposure to surrounding healthy tissues and organs and limits the risk of unanticipated and adverse outcomes related to treatment. ViewRay Technologies, Inc.'s MRIdian® received FDA approval in 2017 and became the world's first MRI-LINAC. Today, ViewRay's MRIdian®, equipped with a 0.35T MRI, finds itself in competition with the 1.5T Elekta Unity.

APPRAISAL CONSIDERATIONS

- ***Normal Useful Life ("NUL")*** – The NUL considered for an MRI machine under a cost approach to value is estimated to be 10 years. Within a cost approach, an appraiser must consider the maintenance history of the subject machine and assign consideration to software and/or hardware overhauls and updates. While such updates can be costly, they can significantly extend the NUL of an MRI machine. Due to the frequency of the aforementioned upgrades, it is not uncommon to see MRIs in the field well beyond a NUL of 10 years.
- ***Installation/Deinstallation Costs*** – The cost of installation associated with MRI machines, including appropriate site planning and build-outs to accommodate the requirements of the subject machine, is often factored into the purchase price of a new machine. Medical equipment appraisers must determine the applicability of installation and deinstallation costs in accordance with the appropriate standard of value utilized within the appraisal (*e.g.*, Fair Market Value Installed, Fair Market Value Uninstalled).
- ***Replacement Cost New*** – Magnetic field strength, as measured in teslas, is the most notable factor in determining replacement cost new ("RCN") of an MRI machine. New 1.0T to 3.0T machines will require an investment from purchasers of anywhere between $1,000,000 to $3,000,000, while a 0.55T machine can cost as much as 50% less. Refurbished units offer buyers a more affordable option, with pricing as low as $250,000.
- ***Functional Obsolescence*** – Factors impacting functional obsolescence,[1] as applied in the valuation of an MRI machine, include features inherent in the machine itself, such as magnet strength, current software, and machine maintenance history. While functional obsolescence often comes in the form of outdated technology, it is also important to consider the functional obsolescence that can occur in conjunction with excess capacity (*e.g.*, using a 7.0T machine in an orthopedic outpatient center).
- ***Economic Obsolescence*** – Abrupt changes in regulatory guidance can have a significant and immediate impact on the value of an MRI machine as applied through economic obsolescence.[2] In the United States, The Centers for Medicare & Medicaid Services ("CMS") sets the standards for healthcare reimbursement with Medicare fee schedules. As discussed in HealthCare Appraisers' publication, Section 135(a) of the Medicare Improvements for Patients and Providers Act of 2008 (MIPPA) amended section 1834(e) of the Social Security Act.[3] The amendment sets stipulations for suppliers of the technical component of advanced diagnostic imaging services (to include MRIs) to have appropriate accreditation by a designated organization in order to receive Medicare reimbursement effective January 1, 2012. Appraisers must remain abreast of amendments and introductions of new regulatory requirements, such as the aforementioned, which could have an adverse impact on MRIs, and should consider such changes within the context of their appraisals of relevant equipment.

CONCLUSION

MRI machines have transformed disease detection, diagnosis, treatment, and patient monitoring in the healthcare space. Comprehensive knowledge of MRI-specific features such as MRI magnet strength and software capabilities is required to appraise MRI machines. As the value of an MRI machine can be heavily dependent upon the special considerations discussed herein, it is necessary to engage a qualified and knowledgeable expert in medical equipment valuation. Healthcare Appraisers has provided valuations of MRI equipment nationwide, and has extensive experience in the valuation of MRI machines across the spectrum.

[1] Defined by the American Society of Appraisers as "a form of depreciation in which the loss in value is due to factors inherent in the property itself and changes in design, materials, or process that result in inadequacy, overcapacity, excess construction, lack of functional utility, excess operating costs, etc."

[2] Defined by the American Society of Appraisers as "a form of depreciation or loss in value caused by unfavorable external conditions."

[3] Centers for Medicare & Medicaid Services: Section 135(a) of the Medicare Improvements for Patients and Providers Act of 2008 (MIPPA) (P.L. 110-275) amended section 1834(e) of the Social Security Act (the Act).