

# OBTAINING IMAGING COST AND QUALITY INFORMATION IN FEMOROACETABULAR IMPINGEMENT: THE PATIENT EXPERIENCE

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## ABSTRACT

**Background:** Recent changes in healthcare have placed increased emphasis on price transparency, quality measures, and improving the patient experience. However, limited information is available for patient cost of obtaining a hip MRI and factors associated with cost variability. For a patient with femoroacetabular impingement (FAI), this study sought to report (1) the availability of pricing and quality information for a hip magnetic resonance imaging (MRI) in the state of Iowa, (2) the time investment required to obtain pricing and quality information, and (3) factors that influence hip MRI cost, quality and the time investment required for patients to obtain cost and quality information.

**Methods:** Within the state of Iowa, 126 unique hospital institutions and 30 active, private orthopaedic practices were identified. All 156 providers were contacted via telephone using a standardized script of a hypothetical 25-year-old adult male patient with FAI requesting a quote for a hip MRI. Cost of the MRI and its components, availability of payment discounts, and MRI magnet tesla (T) were requested. A final bundled cost (FBC) was calculated for each MRI provider with

all available services and discounts applied. The total amount of time needed to obtain a quote from each location was recorded.

**Results:** One hundred and thirty-six of the 156 institutions contacted provided hip MRI services (87%). Median call duration was 9.1 minutes (Range 2.3-25.6). Median FBC was \$2,114.00 (Range \$484.75-4,463.00) across all providers. Hospital median FBC was \$2,261.70 (Range \$909.62-4,463.00) versus \$1,225.13 (Range \$484.75-2,218.40) for independent imaging centers (P<0.0001). No difference in median cost was observed between nine available 3.0 T machines and eighty-nine 1.5 T machines (P=0.2655).

**Conclusions:** MRI cost varies widely across the state of Iowa and within individual metropolitan areas. Hip MRIs cost less at independent imaging centers compared to hospital locations. The amount of time required to obtain quality and cost data for a hip MRI presents a substantial time burden for patients with FAI. Surgeons, healthcare systems, and policy makers should be cognizant of the large price differences for a hip MRI and the time burden placed on patients with FAI to obtain this information.

**Level of Evidence:** IV

**Keywords:** femoroacetabular impingement (fai), magnetic resonance imaging (mri), cost analysis, imaging quality

## INTRODUCTION

Lack of transparency in cost and quality information for healthcare services causes patients confusion when attempting to understand what they are purchasing<sup>1</sup> From a patient and healthcare systems perspective, understanding price and quality information is important as healthcare spending continues to climb and projects to account for greater than 20% of the U.S. gross domestic product in the coming years.<sup>1-4</sup> Previous authors have proposed that increasing the availability of cost and quality data to patients and hospitals would drive the price for healthcare services down due to competition.<sup>1,3,5</sup> Additionally, access to pricing information helps individuals that may need to pay out of pocket for

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### Disclosures:

Chris A. Anthony - Paid advisor for McKinsey and Company in the total amount of: USD 10,000 - USD 100,000;

Robert W. Westermann - Educational support from Smith & Nephew, educational support from Arthrex in the total amount of: USD 10,000 - USD 100,000;

John C. Clohisy - Non-financial support and royalties from Wolters Kluwer Health, personal consultant fees and royalties from Microport Orthopedics, and personal consultant fees and non-financial support from Zimmer Biomet in the total amount of: USD 10,000 - USD 100,000; Stuart L. Weinstein - Publishing royalties and financial or material support from Wolters Kluwer Health in the total amount of: Less Than USD 10,000.

The remaining authors report no potential conflicts of interest related to this study.

Sources of Funding: No sources of funding declared.

**Table 1. Breakdown of Cost Estimates for a MRI<sup>a</sup> of the Hip by Included Components (N=114)**

Components Included	Sample Size	Median Value USD <sup>b</sup>
MRI Technical Exam Radiology Fee Applicable Discount	N=27	\$1,658.2 (484.75-4,090.50)
MRI Technical Exam Applicable Discount	N=30	\$1,847.48 (909.62-3,803.75)
MRI Technical Exam Radiology Fee	N=22	\$2,412.50 (900.00-4,463.00)
MRI Technical Exam <sup>c</sup>	N=35	\$2,392.00 (857.00-3,500.00)

<sup>a</sup>Magnetic Resonance Image; <sup>b</sup>United States Dollars; <sup>c</sup>Location provided no discrete value for discount or stated no discounts are given for up-front cash payment; Median (Range)

healthcare services due to lack of insurance or high deductibles that are attractive for individuals seeking a low monthly cost, such as younger patients.<sup>6</sup>

Femoroacetabular impingement (FAI) is an increasingly recognized clinical entity that typically affects a young patient population.<sup>7,9</sup> Surgical correction of FAI can alleviate symptoms and improve patient function.<sup>8,9</sup> The diagnostic imaging exams of choice for FAI include hip radiography and cross-sectional imaging including hip magnetic resonance imaging (MRI).<sup>10,11</sup> Hip MRI provides critical information regarding the extent of hip disease and, from an economic perspective, leads to substantial and variable out of pocket costs.<sup>10,12</sup>

For a hypothetical patient with FAI, this investigation sought to report (1) the availability of pricing and quality information for a hip MRI in the state of Iowa, (2) the time investment required to obtain pricing and quality information, and (3) factors that influence hip MRI cost, quality and the time investment required for patients to obtain this information.

### METHODS

This study was deemed Institutional Review Board exempt. Hospitals within the state of Iowa were identified using the Iowa Hospital Associates (IHA) database that provides contact information on all hospital institutions within the state. Additionally, Iowa Orthopaedic Society (IOS) member data was utilized to identify 30 active orthopaedic practices that may have an associated imaging center.

All hospitals and orthopaedic practices were contacted via telephone using a scripted query of a hypothetical, 25-year-old male patient diagnosed with FAI (Appendix A) regarding the cash price for a non-contrast MRI of the right hip (CPT code 73721). A maximum of two phone calls were initiated with each location. Similar to previously utilized methods, a call was defined as an attempt to make initial contact via telephone with

**Table 2. Median Call Time by Location Type**

Location Type	Sample Size	Median Call Time in Minutes
Critical Access Hospital	70	9.6 (3.1-25.6)
Urban Hospital	15	7.4 (2.3-25.6)
Rural Hospital	13	7.8 (2.8-16.7)
Independent Imaging Provider	16	8.8 (4.1-22.5)

Reported as: Median (Range)

a location.<sup>13</sup> Transfers to different departments or referrals to call another number resulting from a call were considered part of a single call. Likewise, if a message was left at a location regarding obtaining a quote and that message was returned within three business days, this still qualified as a single call. Messages from a call not returned within three business days, calls that resulted in a location not willing to disclose a quote due to lack of patient information, and calls ending without the opportunity to leave a message were considered a complete call. Any subsequent initiated contact was classified as a second call attempt. Time elapsed to obtain cost and quality information was recorded and defined as starting with any automated or live person response to a call and ending when the call was disconnected. For locations requiring the hypothetical patient to call another number, the timer was not stopped while being connected with the new location. At locations where messages were left, the timer was stopped after disconnecting the initial call and restarted if the message was returned.

All hospital locations that were contacted were considered “hospital MRI” providers whereas all independent orthopaedic practices that were contacted were considered “independent MRI” providers. Of the 126 hospital institutions identified using IHA data, 116 facilities provided hip MRI services. Using IOS data, 20 independent orthopaedic practices offered hip MRI services. In addition to requesting pricing imaging providers were asked if a discount or other financial incentives were available if services were paid for in full using cash or debit up front. Details regarding the components of the MRI price quote, such as radiology reading fees, service charges, and facility fees were asked of locations in order to quantify the amount each component contributed to the final bundled cost (FBC) (Table 1). The FBC consisted of the full amount the hypothetical patient would be billed for all exam components provided by the location (MRI, read, discount etc.), when paying up front with cash or debit on the date of service. Locations offering pricing data were also asked about the quality of their machine in terms of Tesla (T) as machines with higher Tesla values can

**Table 3. IHA location versus Independent Center Call Times**

Location Type	Sample Size	Median Call Time in Seconds
IHA Member	98	9.3 (2.3-25.6)
Independent Imaging Provider	16	8.8 (4.1-22.5)

Reported as: Median (Range)

**Table 4. Median Call Time by Metropolitan Status**

Metropolitan Status	Sample Size	Median Call Time in Seconds
Yes	37	8.7 (2.3-25.6)
No	77	9.6 (2.7-25.6)

Reported as: Median (Range)

improve the detection of cartilage lesions.<sup>14</sup> Attempts to obtain MRI Tesla data via internet search were made for locations where the institution could not provide the data over the phone or failed to return a message asking for MRI tesla. Internet resources for Tesla data included institution websites listing the MRI tesla, press releases listing MRI tesla, and public meeting minutes reporting the approval of MRI machine purchases.

Moreover, hospitals were also classified based on the Centers for Medicare and Medicaid services (CMS) designations listed on the IHA website. The different classifications within our study were “critical access hospital,” “urban,” “rural,” or “rural-referral center.” Additionally, locations were classified as metropolitan and non-metropolitan per the United States Office of Management and Budget that can be found at <https://www.iowadatacenter.org/aboutdata/statisticalareas>. A total of nine metropolitan areas exist in Iowa and are as follows: Ames; Cedar Rapids; Davenport-Moline-Rock Island, IA-IL; Des Moines-West Des Moines; Dubuque; Iowa City; Omaha-Council Bluffs, NE-IA; Sioux City, IA-NE-SD; Waterloo-Cedar Falls.

Descriptive statistics were performed, and the normality of quantitative continuous variables was evaluated using the Shapiro-Wilk test and through exploratory plots (e.g. histograms and Q-Q plots). Because continuous variables were not normally distributed, they were described using median (min-max) values, and between group comparisons were made using the Wilcoxon Rank Sum Test. We constructed frequency distributions for qualitative categorical variables. Statistical significance was set at an alpha level of 0.05. SAS Statistical Software version 9.4 was utilized for all analyses (SAS Institute, Inc., Cary, NC).

**Table 5. Final Bundled Cost of Hip MRI by Metropolitan Status**

Metropolitan Status	Sample Size	Median Cost
Yes	37	\$2,080.00 (484.75-4,047.00)
No	77	\$2,148.00 (925.44-4,463.00)

Reported as: Median (Range)

**Table 6. Final Bundled Cost of Hip MRI by Machine Tesla Rating**

Tesla Rating	Sample Size	Median Cost
1.5T	89	\$2,148.00 (484.75-4,463.00)
3.0T	9	\$1,800.00 (1,047.20-2,910.38)

Reported as: Median (Range)

## RESULTS

One hundred and thirty-six (87.2%) of the 156 hospitals and independent orthopaedic practices contacted provided hip MRI services. One-hundred and fourteen of the 136 (83.8%) hip MRI providers were willing to provide pricing information. Ninety-eight of the 114 locations providing pricing data were hospitals with their own MRI capabilities, while 16 quotes were obtained through independent orthopaedic practices. One hundred and twelve locations provided a discrete price for the actual MRI, 49 were able to comment on radiology reading fees, and MRI tesla data was collected for 98 of the 114 locations (86%). Ninety-seven of the locations (85%) providing a quote required one patient-initiated call, with 17 (15%) requiring two calls. Median call duration was 9.1 minutes (Range 2.3-25.6 minutes) with no differences in call duration by location type or CMS designation (Table 2). Comparison of call duration for hospital locations versus independent orthopaedic practices demonstrated no difference (Table 3). Classifying locations according to metropolitan status yielded no differences in call time needed to obtain a quote (Table 4).

Median FBC for MRI among all locations was \$2,114 (Range \$484.75-4,463.00), while median price for only the MRI component was \$2,376.77 (Range \$685.62-4,475.00). Median FBC stratified by CMS criteria was \$2,234.50 (Range \$987.00-4,090.50) for Critical Access Hospitals (CAHs), \$2,600.00 (Range \$909.62-3,500.00) for Urban, \$2,871.60 (Range \$1,379.40-3,803.75) for Rural-Referral, and \$2,148.00 (Range 925.44-4,463.00) for Rural. Significant differences were observed between CAHs and Rural-Referral locations for both FBC (P=0.0472) and MRI technical exam price (P=0.0442). Hospital based MRI providers had a median FBC of \$2,261.70 (Range \$909.62-4,463.00) versus \$1,225.13 (Range \$484.75-2,218.40) for quotes obtained through independent orthopaedic practices (P<0.0001). Likewise, a significant difference

existed between median MRI technical exam price of hospital-based locations (\$2,472.50) versus independent orthopaedic practices (\$1,391.00) ( $P < 0.0001$ ). Median FBC in metropolitan areas was \$2,080 versus \$2,148.00 in non-metropolitan areas yielding no difference (Table 5). A single metropolitan area was graphically modeled demonstrating the proximity of various price and quality options for a hip MRI within an easily drivable radius (Figure 1). Of the 98 locations with tesla quality information available, 89 provided a 1.5T MRI magnet and nine utilized a 3.0T magnet. For the locations with associated Tesla data, no significant difference ( $P = 0.2655$ ) for FBC existed when comparing 1.5T (\$2,148.00) and 3.0T MRI machines (\$1,800.00, Table 6).

### DISCUSSION

Price and quality transparency are important in the modern healthcare environment focused on quality care delivered in the context of unsustainable rising costs, with diagnostic imaging making up a considerable portion of the bill.<sup>15,16</sup> Prior authors have reported that transparency programs focused on a single item, specifically an advanced imaging procedure such as MRI, resulted in patient savings and utilization of less expensive imaging providers.<sup>12</sup> Further, utilization of cost and quality information is more likely in young and healthy patient populations, such as those affected by FAI, who also experience higher out-of-pocket costs due to various factors, including higher annual deductibles.<sup>17</sup> In a hypothetical young patient with FAI this investigation sought to understand the patient “experience” of obtaining healthcare related price and quality data. Additionally, we sought to understand the variability in hip MRI pricing and quality across a specific geographic location and the factors which may affect pricing and quality.

Utilizing similar methods, previous investigations reported difficulty in obtaining consumer price estimates for an elective procedure (50% success) and complete out-of-pocket quotes (10% success).<sup>13,18</sup> For this study, we report successfully collecting pricing information for 83.8% of all locations that provide adult hip MRI services in the state of Iowa. Additionally, MRI quality, in terms of Tesla, was collected for 86.0% of locations that disclosed adult hip MRI pricing information. Our findings represent relatively high price transparency when compared to previous investigations.<sup>13,18,19</sup>

Even if price and quality data are available to a patient, the time required to obtain this information may be substantial. Previous studies have reported requiring an average of 3.5 calls in successful attempts to obtain pricing estimates for pediatric orthopaedic procedures.<sup>13</sup> We find the patient “experience” when attempting to obtain price and quality information for a hip MRI will

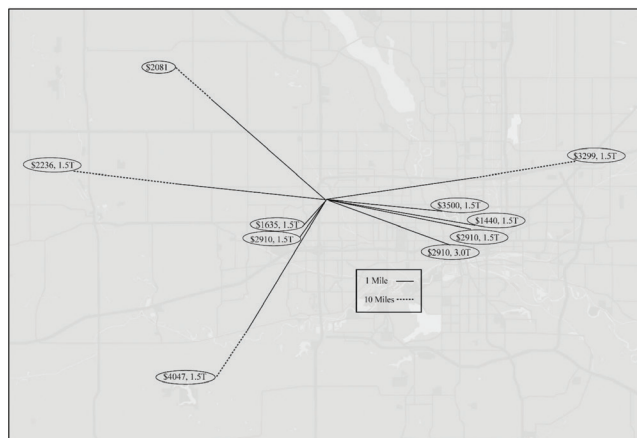


Figure 1. Schematic representation showing proximity of hip Magnetic Resonance Imaging providers, associated price, and available tesla data with a metropolitan area.

require 9.1 minutes per MRI provider contacted. If our hypothetical patient with FAI were to contact three imaging centers seeking quotes within a metropolitan area of Iowa this would likely require almost 30 minutes of time spent. Due to the demonstrated time needed to obtain hip MRI pricing information, we recommend that any healthcare providers ordering hip MRIs be familiar with pricing and quality information for MRI services in their area. We also recommend the development of tools that might provide real time, up-to-date information to a patient when seeking price and quality data for various tests, procedures, and other healthcare services.

Other authors have reported high variability in pricing for computed tomography exams and shoulder MRIs.<sup>20,21</sup> These investigations noted that non-hospital locations had lower costs and decreased variability in pricing compared to hospital locations.<sup>20,21</sup> Similar discrepancies between hospital associated and independent providers has been reported for healthcare services such as bunion surgery and closed reduction with percutaneous pinning for distal radius fractures.<sup>13,18</sup> We report considerable variability in cost for a hip MRI, with a range of \$485 to \$4,463. Breaking down the individual components of the quote, similar variation was present for the hip MRI itself (Range \$685.82-\$4,475) and disclosed radiology fees (Range: \$75-\$1,400). Previous investigations found facility fees and service charges as factors that could play a role in the observed variability in healthcare product pricing.<sup>20</sup> However, data collection for this investigation found no location that could comment on the discrete cost of these components and where they fit into the disclosed price estimates. Based on the high variability for both cost and payment discounts, patients paying out of pocket for a hip MRI exam may benefit from obtaining pricing information from multiple locations within their

surrounding area to find the best price for their financial situation. Providers of hip MRI services should be ready to make detailed information regarding their pricing structures and options available to inquiring patients. Additionally, patients and those ordering hip MRIs should be aware of other hip MRI services in close proximity that could offer a potentially higher or comparable quality service at a similar or lower price (Figure 1). Future investigations should consider factors such as travel costs and lost time at work when considering how to determine the best and most economical location to obtain imaging studies in the setting of FAI.

We report that the median disclosed FBC of a hip MRI was 46% less (\$1,225.13 vs \$2,261.70) at independent imaging centers, and the median technical exam portion cost was 44% less (\$1,391.00 vs \$2,472.50). Higher efficiency due to specialization, in addition to lower facility associated costs, may help further explain this observed difference.<sup>22</sup> In addition, access to imaging services varies based on geographical location, and differences in operational costs among locations has been noted in other studies, both of these factors may influence costs.<sup>23</sup> Using metropolitan and CMS criteria (Urban, CAH, Rural, Rural-Referral) the only significant difference observed was between CAHs and Rural-Referral locations for both MRI technical component price and FBC. When comparing locations with 3.0T MRIs to those with only 1.5T machines, no difference in price or FBC was observed. This lack of difference between 3.0T and 1.5T machines presents an interesting concept, in that the attributed cost for an MRI did not vary based on scan quality, as 3.0T MRIs have been reported to be superior for detecting joint pathology.<sup>14</sup> As evident by significantly higher costs seemingly unrelated to quality, healthcare consumers paying out of pocket for imaging services should be aware of the factors contributing to the price they are charged for these services and consider non-hospital associated imaging alternatives for hip MRI studies.

This study has several limitations. First, the data collected was confined to only the state of Iowa, meaning it may not be generalizable to the entire U.S. or any other state. However, Iowa resident's personal health care spending per capita was \$8,200 in 2014, only \$155 more than the national average of \$8,045, and ranked 27<sup>th</sup> out of 51 locations (States and District of Columbia), which makes it more appropriate for national extrapolation than high or low spending locations.<sup>24</sup> Next, to maintain uniformity we utilized a young patient paying out of pocket in cash who best represents Iowa residents that are uninsured, underinsured, or have high-deductible health plans, all of which are increasingly common in the current healthcare environment.<sup>25</sup> Thus, these results

may be less applicable to the majority of insured Iowans and other alternatively insured populations, but still help highlight the complexity of payment for medical services. Further, although we requested discrete values for all associated fees in this study, not all locations were able to provide complete information. Moreover, this study only evaluated pricing information for non-contrast MRIs, but other procedures such as magnetic resonance arthrography may be routinely utilized by orthopaedic surgeons evaluating patients for FAI. In addition, the data collected to identify independent imaging providers was restricted to locations associated with physicians that are members of the Iowa Orthopaedic Society, which may have limited the number of locations we identified and contacted, possibly excluding some independent imaging providers. Finally, using MRI tesla as a proxy for exam quality is an unavoidable limitation as the quality of an exam is dependent on many factors such as scanning technique and reader reliability, which this study could not evaluate.

Overall, there is high variability in the cost for a hip MRI in the state of Iowa. We report the cost of a hip MRI is less when obtained through independent orthopaedic practices than hospital locations. We also find the amount of time spent obtaining price and quality information presents a significant time burden for patients with FAI. Patients, surgeons and healthcare systems should be cognizant of the potential large price differences between hip MRI service providers in their geographic area.

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